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Popular Science

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Popular Science Monthly

NERVE EXHAUSTION

How We Become Shell-Shocked in Every-Day Life

By PAUL VON BOECKMANN

Lecturer and Author of numerous books and treatises on Mental and Physical Energy, Respiration, Psychology, Sexual Science and Nerve Culture

THERE is but one malady more terrible than Nerve Exhaustion, and that is its kin, Insanity. Only those who have passed through a siege of Nerve Exhaustion can understand the true meaning of this statement. It is HELL; no other word can express it. At first, the victim is afraid he will die, and as it grips him deeper, he is afraid he will not die; so great is his mental torture. He becomes panic-stricken and irresolute. A sickening sensation of weakness and helplessness overcomes him. He becomes obsessed with the thought of self-destruction.

Nerve Exhaustion means Nerve Bankruptcy. The wonderful organ we term the Nervous System consists of countless millions of cells. These cells are reservoirs which store a mysterious energy we term Nerve Force. The amount stored represents our Nerve Capital. Every organ works with all its might to keep the supply of Nerve Force in these cells at a high level, for Life itself depends more upon Nerve Force than on the food we eat or even the air we breathe.

If we unduly tax the nerves through overwork, worry, excitement, or grief, or if we subject the muscular system to excessive strain, we consume more Nerve Force than the organs produce, and the natural result must be Nerve Exhaustion.

Nerve Exhaustion is not a malady that comes suddenly. It may be years in developing and the decline is accompanied by unmistakable symptoms, which, unfortunately, cannot readily be recognized. The average person thinks that when his hands do not tremble and his muscles do not twitch, he cannot possibly be nervous. This is a dangerous assumption, for people with hands as solid as a rock and who appear to be in perfect health may be dangerously near Nerve Collapse.

One of the first symptoms of Nerve Exhaustion is the derangement of the Sympathetic Nervous System, the nerve branch which governs the vital organs (see diagram). In other words, the vital organs become sluggish because of insufficient supply of Nerve Energy. This is manifested by a cycle of weaknesses and disturbances in digestion, constipation, poor blood circulation and general muscular lassitude usually being the first to be noticed.

I have for more than thirty years studied the health problem from every angle. My investigations and deductions always brought me back to the immutable truth that Nerve Derangement and Nerve Weakness is the basic cause of nearly every bodily ailment, pain or disorder. I agree with the noted British authority on the nerves, Alfred T. Schofield, M.D., the author of numerous works on the subject, who says: "It is my belief that the greatest single factor in the maintenance of health is that the nerves be in order."

The great war has taught us how frail the nervous system is and how sensitive it is to strain, especially mental and emotional strain. Shell Shock, it was proved, does not injure the nerve fibers in themselves. The effect is entirely mental. Thousands lost their reason thereby, over 135 cases from New York alone being in asylums for the insane. Many more thousands became nervous wrecks. The strongest men became paralyzed so that they could not stand, eat or even speak. One-third of all the hospital cases were "nerve cases," all due to excessive strain of the Sympathetic Nervous System.

The mile-a-minute life of to-day, with its worry, hurry, grief and mental tension is exactly the same as Shell Shock, except that the shock is less forcible, but more prolonged, and in the end just as disastrous. Our crowded insane asylums bear witness to the truth of this statement. Nine people out of ten you meet have "frazzled nerves."

Perhaps you have chased from doctor to doctor seeking relief for a mysterious "something the matter with you." Each doctor tells you that there is nothing the matter with you; that every organ is perfect. But you know there is something the matter. You feel it, and you act it. You are tired, dizzy, cannot sleep, cannot digest your food and you have pains here and there. You are told you are "run down" and need a rest. Or the doctor may give you a tonic. Leave nerve tonics alone. It is like making a tired horse run by towing him behind an automobile.

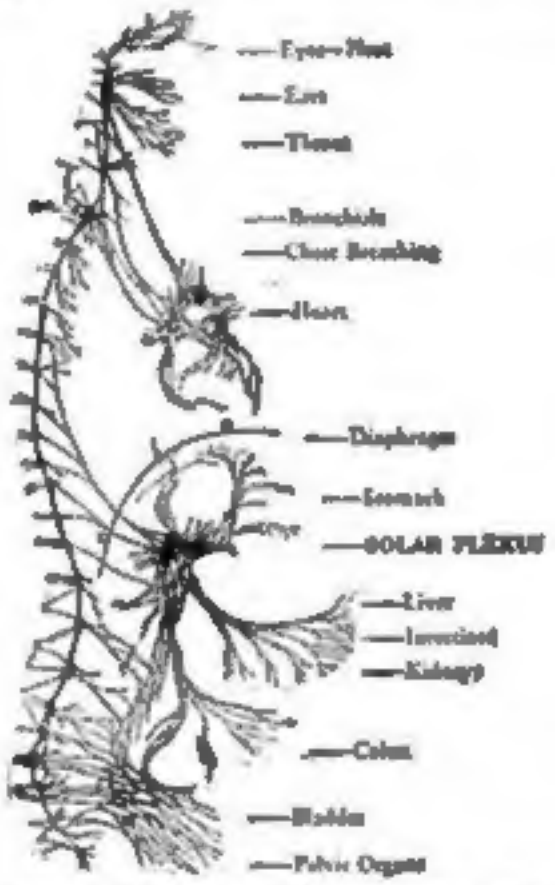

Diagram showing the location of the Solar Plexus, known as the "abdominal brain," the great center of the Sympathetic (Internal) Nervous System. Mental strains, especially grief, fear, worry and anxiety paralyze the Solar Plexus, which in turn causes poor blood circulation, shallow breathing, indigestion, constipation, etc. This in turn clogs the blood with poisons that weaken and irritate the nerves. Thus Mental strain starts a circle of evils that cause endless misery, aches, pains, illness, weaknesses and generally lower mental and physical efficiency.

Our Health, Happiness and Success in life demands that we face these facts understandingly. I have written a 64-page book on this subject which teaches how to protect the nerves from every-day Shell Shock. It teaches how to soothe, calm and care for the nerves; how to nourish them through proper breathing and other means. The cost of the book is only 25 cents. Remit in coin or stamps. See address at the bottom of page. If the book does not meet your fullest expectations, your money will be refunded, plus your outlay of postage.

The book "Nerve Force" solves the problem for you and will enable you to diagnose your troubles understandingly. The facts presented will prove a revelation to you, and the advice given will be of incalculable value to you.

You should send for this book today. It is for you, whether you have had trouble with your nerves or not. Your nerves are the most precious possession you have. Through them you experience all that makes life worth living, for to be dull nerved means to be dull brained, insensible to the higher phases of life—love, moral courage, ambition and temperament. The finer your brain is, the finer and more delicate is your nervous system, and the more imperative it is that you care for your nerves. The book is especially important to those who have "high strung" nerves and those who must tax their nerves to the limit.

The following are extracts from letters from people who have read the book and were greatly benefited by the teachings set forth therein:

"I have gained 12 pounds since reading your book, and I feel so energetic. I had about given up hope of ever finding the cause of my low weight."

"I have been treated by a number of nerve specialists, and have traveled from country to country in an endeavor to restore my nerves to normal. Your little book has done more for me than all other methods combined."

"Your book did more for me for indigestion than two courses in dieting."

"My heart is now regular again and my nerves are fine. I thought I had heart trouble, but it was simply a case of abused nerves. I have reread your book at least ten times."

A woman writes: "Your book has helped my nerves wonderfully. I am sleeping so well and in the morning I feel so rested."

"The advice given in your book on relaxation and calming of nerves has cleared my brain. Before I was half dizzy all the time."

A physician says: "Your book shows you have scientific and profound knowledge of the nerves and nervous people. I am recommending your book to my patients."

A prominent lawyer in Ansonia, Conn., says: "Your book saved me from a nervous collapse, such as I had three years ago. I now sleep soundly and am gaining weight. I can again do a real day's work."

The Prevention of Colds

Of the various books, pamphlets and treatises which I have written on the subject of health and efficiency, none has attracted more favorable comment than my sixteen-page booklet entitled, "The Prevention of Colds."

There is no human being absolutely immune to Colds. However, people who breathe correctly and deeply are not easily susceptible to Colds. This is clearly explained in my book NERVE FORCE. Other important factors, nevertheless, play an important part in the prevention of Colds—factors that concern the matter of ventilation, clothing, humidity, temperature, etc. These factors are fully discussed in the booklet Prevention of Colds.

No ailment is of greater danger than an "ordinary cold," as it may lead to Influenza, Grippe, Pneumonia or Tuberculosis. More deaths resulted during the recent "Flu" epidemic than were killed during the entire war, over 6,000,000 people dying in India alone.

A copy of the booklet Prevention of Colds will be sent *Free* upon receipt of 25c. with the book "Nerve Force." You will agree that this alone is worth many times the price asked for both books. Address:

PAUL VON BOECKMANN

Studio 161, 110 West 40th St., New York

Publisher's Note: **Prof. von Boeckmann is the scientist who explained the nature of the mysterious Psychophysic Force involved in the Coueism-Abbott Feats; a problem that had baffled the leading scientists of America and Europe for more than thirty years, and a full account of which has been published in the March and April issues of Physical Culture Magazine.**

Popular Science Monthly

JULY, 1921

Volume 99-No. 1

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POPULAR SCIENCE MONTHLY is issued monthly. Yearly subscription in the United States, $3.00. Canada, $3.50. Foreign, $4.00. Single copy, 25 cents.

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Modern Publishing Company
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CONTENTS—*Continued*

Statement of the Ownership, Management, Circulation, etc., required by the Act of Congress of August 24, 1912, of Popular Science Monthly, published monthly at New York, N. Y., for April 1, 1921. State of New York, County of New York, ss. Before me, a notary public, in and for the State and county aforesaid, personally appeared O. B. Capen, who, having been duly sworn according to law, deposes and says that he is the Business Manager of the Popular Science Monthly and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 443, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor and business managers are: Publisher, The Modern Publishing Company, Inc., 225 West Thirty-ninth Street, New York, N. Y. Editor, Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y. Managing Editor, Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y. Business Manager, O. B. Capen, 225 West Thirty-ninth Street, New York, N. Y. 2.—That the owners are: The Popular Science Publishing Company, Inc. 225 West Thirty-ninth Street, New York, N. Y. Stockholders of Popular Science Publishing Company, Inc., Henry J. Fisher, 22 William Street, New York, N. Y.; Oliver B. Capen, 225 West Thirty-ninth Street, New York, N. Y.; Robert Cole Wilson, 683 Springfield Avenue, Summit, N. J.; Waldemar Kaempffert, 225 West Thirty-ninth Street, New York, N. Y.; George B. Agnew, 22 William Street, New York, N. Y.; Susan D. Bliss, 22 William Street, New York, N. Y. 3.—That the known bondholders, mortgagees, and other security holders owning or holding 1 per cent. or more of total amount of bonds, mortgages, or other securities are: Importers and Traders National Bank, 247 Broadway, New York, N. Y.; H. J. Fisher, 22 William Street, New York, N. Y. 4.—That the two paragraphs next above, giving the names of the owners, stockholders, and security holders, if any, contain not only the list of stockholders and security holders as they appear upon the books of the company, but also, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting, is given; also that the said two paragraphs contain statements embracing affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner; and this affiant has no reason to believe that any other person, association, or corporation has any interest direct or indirect in the said stock, bonds, or other securities than as so stated by him.

(Signed) O. B. CAPEN, *Business Manager.*

Sworn to and subscribed before me this 31st day of March, 1921.

Arthur A. Bleevelt, Queens County—2767, New York County—838, New York Reg. 1612.
(Seal.) My commission expires March 30, 1921.

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Classified Advertising Manager,

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Quick-Action Advertisements continued on page 9

Quick-Action Advertisements continued from page 8.

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[illegible] New method. [illegible] Duluth, Minnesota.

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[illegible] Bulletin [illegible] Chemical Company [illegible] Milwaukee, Wisconsin.

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MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

MISCELLANEOUS

[illegible] opens and locks thousands of different locks. [illegible] Master Key Company, 34 Manhattan Building, Milwaukee, Wisconsin.

[illegible] Sanitary [illegible] Albany, New York.

HAVE your watch [illegible] speedometer [illegible] illuminated [illegible] to see them plainly in the dark. [illegible] New York.

TATTOOING, an interesting Art. Write for Supply [illegible] Ohio.

[illegible] Make Money. We make excellent Rubber Bands [illegible] Newark, New Jersey.

X-RAY Wonderful [illegible] Price [illegible] Agents wanted. [illegible] Street, West Springfield, Massachusetts.

TELEGRAPHY

TELEGRAPHY. Morse and Wireless taught at home [illegible] Telegraph [illegible] Company [illegible] New York.

TELEGRAPHY [illegible] and Wireless [illegible] Accounting taught quickly. [illegible] All expenses low. [illegible] Dodge's Institute, [illegible] Street, Valparaiso, Indiana.

OFFICE AND FACTORY EQUIPMENT

ADDRESSING, duplicating, mailing [illegible] dictating machines, etc. [illegible] Machinery Company, [illegible], Illinois.

LETTER SPECIALISTS

FRANK [illegible] writes the Best Sales Letters in the World. Floyd Thelma [illegible], Box [illegible], Atlantic City, New Jersey.

MR. ADVERTISER: Ask today for a copy of the "Quick-Action Advertising Rate Folder." It contains some really important facts which will prove interesting and valuable to you. It also tells "How You Can Use Popular Science Monthly Profitably." You'd like to know, wouldn't you? Manager Classified Advertising, Popular Science Monthly, 225 West 39th Street, New York.

If I Had But Two Dollars In The World I Would Pin Them to The Bottom of This Page!

Because This is Your *ONLY* Opportunity To Order Matysek's

Muscle Control Course for but $2.00

In the future the price will be higher

It is the scientific system of control of all the physical functions. You can cure yourself of any functional disorder. You will be independent of all medicines and drugs which you know cannot bring health and are always debilitating. When physicians fail in getting results they suggest Matysek, the Maker of 100% Men.

ANTONE MATYSEK

the muscular phenomenon, the man who is offering to place you on the [illegible] When you find your place [illegible] you will be a REAL MAN and then will achieve your [illegible] aim!

A "Body Beautiful" Maker

Thousands of men say this course is the surest and quickest muscle bringing-out stimulant. A curative system of exercises that produce really athletic men with graceful outlines full of strong personality.

These exercises are the CHIEF SECRET of why I am growing despite my age each day stronger and better developed as well.

Course Consists of

Two handsomely finished charts containing twenty-one beautifully produced pictures of myself, many of decidedly larger size than the above specimen, showing every detail as to how to perform the movements with absolute correctness. The instructions are in book form and straight from the shoulder such as only an expert who went through the mill himself could ever possibly produce.

Some Subjects are

How to quickly make responsive the inactive bowels, easily correct the rounded shoulders, in no time expel the bothering gas out of the stomach, promptly chase away the staleness of the body, strengthen the nerves and internal organs, easily overcome the body's [illegible], strengthen the sexual organs, control every muscle of your body, store up energy for feats of strength, also complete relaxation and contraction [illegible] the best way to arouse your inactive nerves [illegible] of better blood circulation [illegible] way to increase your chest circumference, the famous shoulder blade [illegible] how to thicken the [illegible] how to learn the art of making your shoulder [illegible] development and control of the neck muscles [illegible] of the back, expansion of the abdominal muscles and [illegible] of the [illegible] best [illegible] thighs [illegible] other secrets [illegible] from the abdominal region [illegible] how to master correct posture [illegible] how to pose for good pictures. Advantage of perfect co-ordination of muscles and mind through concentration which brings success and all the good things that go with it and many other vital pointers you need every day too numerous to mention.

Of Particular Interest to YOU

Every reader of Popular Science [illegible] Send [illegible] real.

Let My Muscle Control Exercises Mold Muscle On You Quickly and Solidly!

Only ten minutes a day in the privacy of your own home [illegible] I know that in less than five days [illegible] will be treated to a most surprising [illegible]. If you are already [illegible] these Muscle Control exercises will [illegible] your progress [illegible] own happiness, start [illegible] into a real man. Do not merely drag on.

You Can Well Afford It. Costs But $2.00

I guarantee [illegible] results are absolute [illegible] money back. [illegible] let me help you. I will [illegible] show you the main secret that helped me to get what I [illegible] in addition you [illegible] gladly [illegible] It is easy and YOU CAN DO IT [illegible] RIGHT [illegible]

Send Coupon Today

Simply tear off the coupon below, mail with but $2.00 (Canadian and Foreign orders $2.20) and leave the rest to me.

Prof. Matysek

Muscle Control Dept. 1500, 523 N. Charles St., Baltimore, Md.

[illegible] PROF. [illegible] Dept. 1500 [illegible] Baltimore, Md. [illegible] Muscle Control Course [illegible] promptly refunded [illegible] within 48 hours.

Name

Address

City State P.S. 7-21

Notice: The above signatures are guaranteed to be entirely truthful.

Quick-Action Advertisements continued on page 10

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PHOTOPLAYS Wanted. Big prices paid. You can write them. We show you how. Free particulars. Rex Publishers, Box 175, P 30, Chicago.

MAKE $25.00 to $50.00 Nightly. We furnish professional machine, films, supplies, etc. suitable for traveling or stationary use. No experience needed. We teach you the business. Little money required. Easy payments. Large Catalog Free. Dept. 612 Monarch Theater Supply Company, 228 Union Avenue, Memphis, Tennessee.

Quick-Action Advertisements continued from page 10

BOOKS AND PERIODICALS

[illegible]

REAL ESTATE FARM LANDS

[illegible]

FOR INVENTORS

[illegible]

PATENT ATTORNEYS

[illegible]

Listen To Me!

ELECTRICAL EXPERTS

EARN $70 to $200 a Week

Electrical experts are in great demand in all parts of the world. This is the great Electrical age and Electric power is moving the world. I can train any ambitious man to become a Certificated Electrical Expert in a short time and able to fill one of these big paying positions.

I WILL TRAIN YOU AT HOME

I am Chief Engineer of the great Chicago Engineering Works and know just the kind of practical up-to-date training you need to hold the best Electrical positions. I can train you at home by my wonderful lessons and Electrical apparatus which I send you.

SUCCESS GUARANTEED

I have trained hundreds of Electrical Experts and can do the same for you. So sure am I of this that I guarantee under bond to return every cent if you do not succeed. No school will do this.

FREE Big Electrical Outfit

A fine set of Electrical supplies, instruments and tools for practical work absolutely free—while they last. I am giving every student one of these great outfits. Write now—today.

Write! Send today for proof lessons and wonderful Electrical Book BOTH FREE. Send coupon or postal.

CHIEF ENGINEER COOKE,
Chicago Engineering Works, Dept. 27,
1918 Sunnyside Ave., Chicago, Illinois

FREE OUTFIT COUPON

CHIEF ENGINEER COOKE, Chicago Engineering Works, Dept. 27 1918 Sunnyside Ave. Chicago, Ill.

Please send me ABSOLUTELY FREE your book, How to Become an Expert Electrician, and your Special Electrical Proposition.

Name

Address

City State

Quick-Action Advertisements continued on page 12

AGENTS AND SALESMEN WANTED

[illegible]

HELP WANTED

[illegible]

Quick Action Advertisements continued from page 14

SPLENDID [illegible] opportunity. Spare or whole time. No canvassing, good money. [illegible] Builders, Jamestown, New York.

GOVERNMENT Clerks needed badly. [illegible] Permanent. Few to travel. Write Mr. [illegible], Former Government Examiner, 195 St. Louis, Missouri.

[illegible] money easily earned at home [illegible] Company, [illegible], Kentucky.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, [illegible] Westover Bldg., Kansas City, Missouri.

BUSINESS OPPORTUNITIES

SUBSTANTIAL manufacturing corporation wants capable men to establish branch and manage salesmen. $300 to $2000 necessary. Will allow expenses to Baltimore as explained. Address Mr. Clemmer, [illegible] N. Eutaw St., Baltimore, Maryland.

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EXPERT Chemist will furnish Formulas and Trade Secrets in all lines. Lists free. W. L. Cummings, Ph. D., [illegible] Avenue, Syracuse, New York.

BE a detective. Excellent opportunity, good pay, travel. Write C. T. Ludwig, 423 Westover Bldg., Kansas City, Missouri.

[illegible] CASH Yearly in your backyard. No mushroom dope. Particulars free. Metz, [illegible] West [illegible], New York.

[illegible] correspondence Courses of all kinds sold, [illegible] bought. Lee Mountain, Pisgah, Alabama.

I MADE $25,000 with small Mail Order Business. Sample article 25c. Free booklet. Stamp. Alss Scott, Cohoes, New York.

ENTER a new business. Earn $3,000 to $6,000 yearly in professional fees making and fitting a foot specialty. [illegible] everywhere with all the trade you can attend to. Easily learned by anyone at home in a few weeks at small expense, no further capital required, no goods to buy, job hunting, soliciting or agency. Address Stephenson Laboratory, 18 Back Bay, Boston, Massachusetts.

WE start you in business, furnishing everything. Men and women. $30 to $100 weekly operating our New System Specialty Candy Factories anywhere. Opportunity lifetime. Booklet free. W. Ragsdale Company, East Orange, New Jersey.

MANUFACTURING corporation. A large modern Middle Western Manufacturing Institution will consider proposals from inventors and small manufacturers for the purpose of buying outright or manufacturing on royalty. Prefer light brass products but will consider any high grade proposition. Write or wire Box 338, Kokomo, Indiana.

[illegible] Profit Manufacturing big seller. New field. $3.00 Days Complete Equipment. Box 13, A, Akron, Ohio.

BUSINESS brokerage easily understood. Big earnings possible. Details free. Kydonas System, Box 447, St. Louis, Missouri.

MAKE money at home making toys. We show you how. Send 10c for [illegible] No Stamps. [illegible] Designing Company, 339 [illegible] Street, Decatur, Georgia.

BE Moving Picture Operator. Big pay. My system helps you qualify. Answers to [illegible] and questions. $1. Chief Operator Stepanek, [illegible] West St., New Britain, Connecticut.

HOW and what to invent for profit free. Patent News, 10, Washington, D. C.

STAMPS AND COINS

[illegible] different stamps, also packet 5 unused, China ship set, 2 scarce animal stamps, large $1.00 U. S. revenue, perforation gauge, millimeter scale, ruler and price lists. All for 9c. We buy stamps. Fennell Stamp Co., Dept. [illegible], Fullerton Bldg., St. Louis, Missouri.

CALIFORNIA gold, quarter size 27c; [illegible] size 53c. White cent and catalogue 10c. Norman Shultz, Box 146, Colorado Springs, Colorado.

1000 different stamps $3.00; 500, $1.25; 200, 25c; 100, 12c. Approvals. [illegible] Shields, 5932 Prairie, [illegible].

CALIFORNIA gold quarter size and [illegible] Villa coin and catalog 10c. Homer Shultz, [illegible], Missouri.

[illegible] Genuine Foreign Stamps, Mexico War issues, Venezuela, Salvador and India Service, Guatemala, [illegible] etc., only 10c. Finest Approval Sheets, [illegible]. Agents wanted. Big 72-page list free. We buy stamps. Established 25 years. Hussman Stamp Company, Dept. 65, St. Louis, Missouri.

STAMPS 20 unused, All different, 3 cents. Mention paper. Quaker Stamp Co., Toledo, Ohio.

$2 to $500 paid for hundreds of old coins dated before 1895. Send 10 cents at once for new illustrated coin value book. Size 4x7. It may mean your fortune. Clarke Coin Company, Box 9, Le Roy, New York.

STAMPS 50 varieties, Transvaal, Brazil, Peru, Cuba, Mexico, etc., [illegible] different [illegible] Hinges 10c. 1000 mixed 40c. List free. I buy stamps. C. Stegman, 5949 Cote Brilliante, St. Louis, Missouri.

[illegible] different [illegible] 15c [illegible].

STAMPS [illegible] different [illegible], Nicaragua, [illegible] $1.50 [illegible]. Agents wanted [illegible] free [illegible], Colorado.

[illegible] different coins [illegible] Nickel, [illegible] Avenue, Washington, D. C.

[illegible] French Colonies, etc. [illegible] approval selections. [illegible] Edgewood Stamp Company, Dept. [illegible], Milford, Connecticut.

[illegible] War Stamp Packet free. [illegible] Schenectady, New York.

[illegible] page [illegible] of coins for sale free. [illegible] William Hesslein, 101A Tremont Street, Boston, Massachusetts.

A NET [illegible]. Write for approvals. Lanes Stamp Company, Helena, Maine.

20 different Russia 10c. Browne Stamp, 111 Wilbur, Wollaston, Massachusetts.

[illegible] different Stamps [illegible]. C. Belitz, Box 1064, Detroit, Michigan.

Learn Mechanical Drawing

Are you earning less than $35 a week? Can you reasonably expect your present position to pay you $35 to $100 a week in the near future? If not this offer will interest you. We offer to qualify you for a profession which, at the very start, pays higher salaries than the average man receives. We offer you the best personal service obtainable. We offer you personal instruction in mechanical drawing and teach you expert Draftsmanship in your spare time at your home by mail in the same practical way that you would learn it in any big Drafting department. We offer to qualify you for one of the many high salaried positions in the Drafting field, and to keep you in touch with openings for Draftsmen in big machine shops, industrial plants, manufacturing concerns and United States Government Departments. We guarantee to start you on real Drafting work at once qualifying you as a thoroughly trained professional Draftsman, capable of succeeding from the very start. One of the many outstanding features of our training is that it qualifies you in an unusually short time.

> I personally stand back of the Columbia School of Drafting [illegible]
>
> *Roy C. Claflin,*
> President

Become a Chief Draftsman

You cannot make a mistake by taking up mechanical drawing. The field is not crowded, nor can it be. No single profession to-day offers better opportunities. The great need for trained Draftsmen continues to increase. Each step forward in mechanical development creates a need for more trained Draftsmen. Promotion in this field is sure and certain. Men who start as Draftsmen are often advanced to Chief Draftsmen, Chief Engineer, Production Manager or other high salaried positions. There is a constant demand for our graduates. We cannot supply them rapidly enough. Many of them are accepted even before they complete their training. This unusual demand for "Columbia" Trained Men is explained by the fact that our students enter upon actual drawing work the day they receive their first lesson. They spend no time with unnecessary preparation or useless theory.

The Largest Institution Specializing in the Training of Draftsmen Teaches You Mechanical Drawing at Your Home

This is the mechanical age in world history. The day of big opportunities for technically trained men is here. Especially is this true in the case of Draftsmen on whom the mechanical industries of America and the entire world depend. On no one profession does the continued development of machinery so nearly center. With the training which we can give you at your home your services will always be in demand, at a premium, in this permanent, highly paid field.

FREE
To Our Students

- Sixteen piece drawing outfit.
- Eleven Piece set of highest grade drafting instruments in plush lined case.
- [illegible] official drafting [illegible].
- Services of our Students Employment [illegible].
- [illegible]
- Engraved diploma on graduation.
- [illegible]

Drawing Instruments Furnished

We supply our students with complete drawing equipment. A professional drawing outfit is furnished together with a highest grade set of Drafting instruments for your permanent use.

No Previous Training Necessary

As our students are put into actual practice at the beginning, they grasp the essentials of drawing quickly. The lessons supplied are thorough, clear, and easily understood even by those who have had no previous technical training of any kind. No previous experience or special education is necessary. Send attached coupon today for valuable Book FREE.

COLUMBIA SCHOOL of DRAFTING
ROY C. CLAFLIN, President
Dept. 1457, 14th and T Streets
WASHINGTON, D. C.

RETURN COUPON FOR FREE BOOK

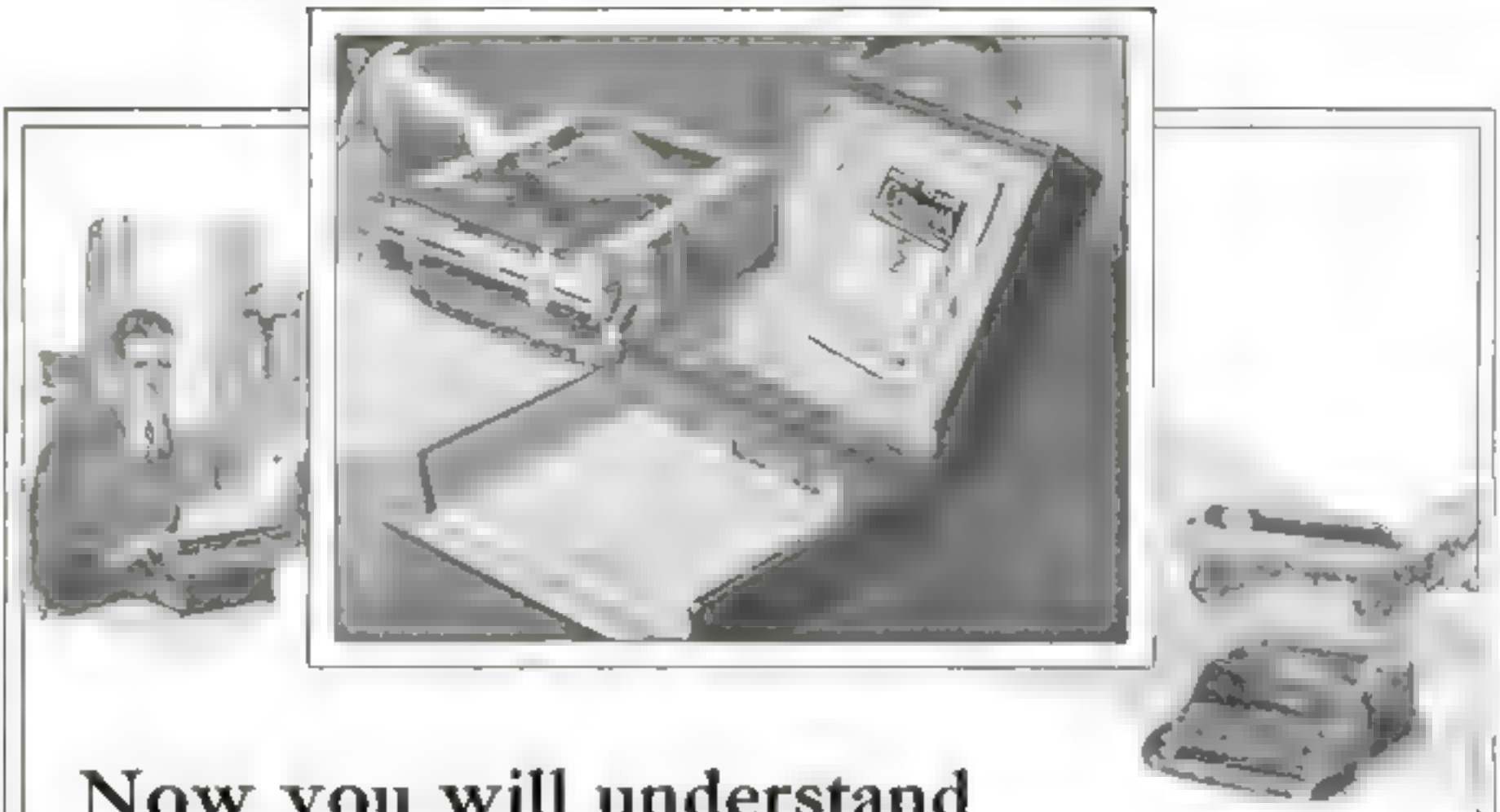
Columbia School of Drafting
Dept. 1457, 14th and T Streets, WASHINGTON, D. C.

Without obligation to me please send me your illustrated book on Drafting telling how I can secure your complete home study course and your help in securing a position as Draftsman.

Name .... Age ......

Address ....

City .... State ......



Now you will understand the reason why Corona folds

YOU wouldn't carry a jack-knife open; nor a book, nor a traveling bag, nor a fountain pen. When you want to use them they're open, when you carry them they're closed.

Merely as a contributor to your convenience Corona's patented folding feature would be tremendously worth while. But there is another and more fundamental reason why it is of so much importance to you

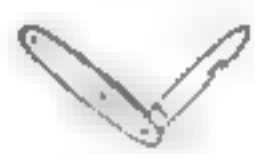
In no other way could you have *all* of the advantages of a normal, practical typewriter without the weight and bulk of a "standard" machine

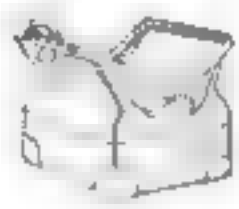
Take the type-bar as a specific instance. It is the same length as the type-bar of "standard" machines and it travels through the same 90 degree arc. Hence the same speed as a bulky machine, and the same lightness of touch.

The Corona dealer can show you a half dozen advantages of the same character.

ASK him to show them. Open the case, unfold Corona and write—how responsive its action, how easy its touch. Fold it up, slip it back in its case and close the cover—now you'll understand the reason why Corona folds.

The price of a brand new Corona, including the carrying case, is only $50 00. You can rent a Corona for a small monthly sum, or you can buy on easy payments.





"Fold it up—take it with you—typewrite anywhere"

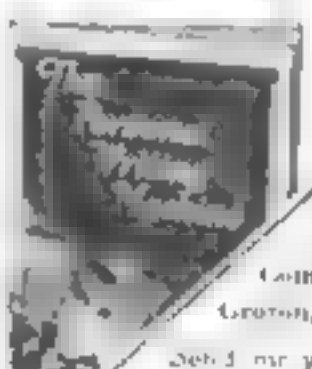
CORONA

The Personal Writing Machine

TRADE MARK

Built by CORONA TYPEWRITER COMPANY, Inc., Groton, N.Y.

There are more than 1,000 Corona Dealers and Service Stations in the U. S.



Corona Typewriter Company, Inc. Groton, New York

Send for your interesting booklet No. 712 about Corona

Name ..

Address ..

Popular Science Monthly

July, 1921; Volume 99, No. 1
25 Cents a Copy; $3 a Year

Published in New York City at
225 West Thirty-ninth Street

Curing Disease with Ultra-Violet Light Rays

This treatment is coming widely into use

By Philip Schwarzbach

LIGHT, as a healer of ills, has been used by people throughout history. The early Egyptians and Romans took sun baths when they were suffering from disease, believing that it was the heat in the sunlight that helped them. Sun baths are still somewhat in vogue, but we know now that their stimulating effect is due to the chemical action of sunlight, not to its heat.

White light is a composite. A beam of sunlight, as you know, can be spread out into a spectrum from infra-red to ultra-violet. The infra-red rays are the warm ones; they possess very slight chemical properties. The ultra-violet rays have strong chemical properties. And the ultra-violet rays (rays that cannot be seen, are ultra in this respect. Science has proved that the chemical rays are the ones that cure. Hence it behooves sufferers to get as much ultra-violet ray treatment as possible.

Why the Sun Will Not Do

Will the sun fill the bill? Not very well; its rays must pass through the various gases that surround the earth, and these gases tend to absorb the ultra-violet rays. Hence, when the rays reach us, their chemical powers are not very strong except in high altitudes.

Artificial light, therefore, has been resorted to for producing ultra-violet rays of any great intensity. The electric arc was the first tried. In connection with this an interesting story is told. There was a certain workman who had suffered for years from rheumatism. He was given a job that necessitated his working near an arc light of great intensity. In a short time his rheumatism disappeared completely. He told his fellow workmen of it, and those who were in any way afflicted stayed close to the light; they too were helped.

Catarrh is a difficult disease to cure but under ultra-violet ray treatment the patient improves rapidly. Here a physician is administering ultra-violet ray treatment by means of a quartz pencil. The rays have a chemical effect on the nasal cavity, killing bacteria and improving the blood condition

It was soon realized that the arc light was much richer in ultra-violet rays than sunlight—but it also had an injurious effect on the skin. The heat rays in the arc light had to be removed before it could be used intensively. Niels Finsen, one of the pioneers in ultra-violet-ray history, found the way to do this, and made it possible for the arc light to be actually pressed against the skin. Besides helping to cure such systemic diseases as rheumatism and gout, the arc light is very helpful in cases of tuberculosis. It inhibits the growth of tubercle bacilli, even though it does not always cure the patient.

The Value of Quartz

The arc light, however, is rather out of fashion to-day. Its place has been taken by the quartz mercury vapor lamp, which is more effective and more economical to operate. Unlike glass, quartz is almost completely transparent to ultra-violet rays, and it can be heated to a very high temperature without danger of injury. The passage of an electric current through mercury vapor generates ultra-violet light.

By means of a quartz tube the cavities in the head can be penetrated, and internal as well as external treatment can be given. The picture on this page shows a patient receiving ultra-violet ray treatment for catarrh by means of a quartz pencil. Not only is the treatment pain-

Instead of removing diseased tonsils, in many cases ultra-violet ray treatment is now given. After a few seconds the disease germs are killed

less, but it is not at all dangerous. Results are obtained quickly without any violent reaction.

What is the secret of this violet-ray treatment? Why does it help cure all kinds of ailments? The answer that Dr. George W. Crile gives to these questions is that it raises the index of a patient's metabolic efficiency. Metabolism is the constant building up and destroying of the cells of the body. The process is continuous, and should occur regularly and equally. The amount of destruction should always equal the amount of rebuilding. When this does not occur, disease of some sort sets in. Take, for example, the disease known as dropsy; it occurs when the body takes in more water than it throws off

Many Diseases Are Cured

Ultra-violet rays, as has been mentioned before, are rich in chemical properties; hence, when they are turned on the body, they agitate the cells. As a result, the cells regain their metabolic equilibrium and proceed to function properly

And now let us consider the various diseases and ailments that are cured by this treatment. In the first place, ultra-violet light has a very soothing effect on human beings. If you are overworked, worried, nervous, or under severe mental strain, the action of the rays will relieve the congestion in your body and greatly refresh you.

The most valuable work that the ultra-violet ray does is in connection with tuberculosis. A victim who is suffering from chills, fever, and severe body pains will find that these disappear after a few treatments. His appetite will improve, and he will grow stronger and heavier. As the treatments are repeated, his skin will become tanned, changing in time to a copper color, and then to a deep brown. Do not be alarmed; the darker he becomes the better he will feel.

Anemic people who are in danger of getting tuberculosis should have ultra-violet ray treatments regularly they will improve the composition of the blood and help ward off the dread disease. Poor circulation and low oxidation are also helped by ultra-violet rays. Neuritis, lumbago, colds, influenza, pneumonia, asthma, nasal and pharyngeal infection, ulcers, boils, and various skin diseases improve after treatment. Persons who have a tendency to baldness should seek the ultra-violet ray specialist.

In all branches of medical science the ultra-violet ray lamps are coming into use. They check the increase of injurious bacilli, thereby helping to cure many contagious diseases, and frequently they eliminate the necessity of an operation.

Rheumatism is promptly relieved by ultra violet ray treatment The rays pass through a quartz lamp and are directed at the diseased part of the body

Picking Cotton by Machine

It works five times faster than the hand

ALTHOUGH we have grown used to machines on the farm, there is one agricultural operation that has for years baffled the inventors' skill—that is, the picking of cotton. Even in this day of machinery, cotton the world over is generally harvested by hand.

But an American engineer has recently perfected a cotton-picking machine that reminds one of the machine clippers used for removing the wool from sheep. The picker head, containing three drums rotated by a flexible shaft from the tractor on which the apparatus is mounted, is attached directly to a large flexible tube through which the picked boll of cotton is drawn by suction from a small blower also carried on the tractor. A part of the equipment is a container for the harvested cotton, in the form of a large box or an ordinary sack. The big flexible tube leads to this container.

The operator simply holds the picking head against the cotton-boll and the machine does the rest. First the boll is caught by the brush-carrying drums in the head, and their rotation pulls the fluffy substance through to a third rotating member having prongs on it, which comb the cotton free of any part of the stalk or leaves that may remain with the cotton after it has come this far into the head. The sectional view shows clearly how the device works. Drive for the rotating drums in the head is by means of a flexibly jointed shaft driven by a small garden tractor.

Here is the picker head, with three drums rotated by a shaft from the tractor on which the apparatus is mounted

The operator holds the cotton-picking machine against the cotton-boll, and the picked boll is sucked through a tube into a sack

The maker of this implement claims that one person operating one of these pickers can harvest five times as much cotton in a day as he could if he did it by hand.

The Pons-Winnecke Comet Will Almost Hit the Earth

ACCORDING to early calculations, the present orbit of the Pons-Winnecke comet was expected to collide with the earth in June. On April 10 Professor Barnard, of the Yerkes Observatory, located it, and later calculations indicated that the expected collision would not occur.

Even should the earth pass through the head of the comet itself, there are reasons for concluding that nothing would happen beyond a great shower of meteors. It is affirmed that comets' heads are not solid, but represent a huge flock of small meteoric bodies and earthly substances, often displaying an illumination of electric origin.

In the past the earth has encountered more than one tail, and probably that of Halley's comet in 1910, without damage. A comet's tail is so rarefied that it totally vanishes when close to or touching the earth.

Our atmosphere acts as a safeguard against the intrusion of meteoric matter by dissipating most of it into vapor before it has time to reach the surface of the earth. Otherwise an encounter with a comet's head might make matters decidedly uncomfortable.

Inhaling Medicine

The latest method of treating tuberculosis

WHEN disease has taken firm hold on the breathing apparatus, it becomes necessary to aid nature by carrying germ-destroying agents directly to the seat of the trouble. In normal respiration, air invariably laden with germs and impurities is drawn into the lungs by the expansion of the chest, which causes a diminution of the air pressure in the lungs. All the air thus inhaled does not, as a rule, penetrate to the deep-seated regions.

Dr. Arnold Gachwend, a practitioner in Paris, has conceived of a plan for introducing pure air charged with vapors of disinfectant medicaments into the lungs under pressure. One of the pictures accompanying this article illustrates the boiler plant in which the steam for the atomizers is generated. Another picture shows patients taking inhalation treatments. The disinfecting vapors are administered through a tube that the patient holds in his mouth during the treatment. Dr. Gachwend's sanatorium has almost none of the appearance of the ordinary doctor's plant. Separate compartments accommodate the patients, and in each one is a stool, also an inhaler jutting out from a screen. Back of the screen is located the apparatus for charging the steam with medicines, and provision is made for measuring and regulating the temperature of the vapor, the percentage of disinfectant, and the pressure deemed necessary in each case.

A patient taking the latest treatment for tuberculosis back of the screen is the apparatus for charging the steam with medicine

The boiler plant in Dr. Gachwend's inhalatorium in Paris; here is generated steam for treating patients

Pig Iron Made without a Blast-Furnace

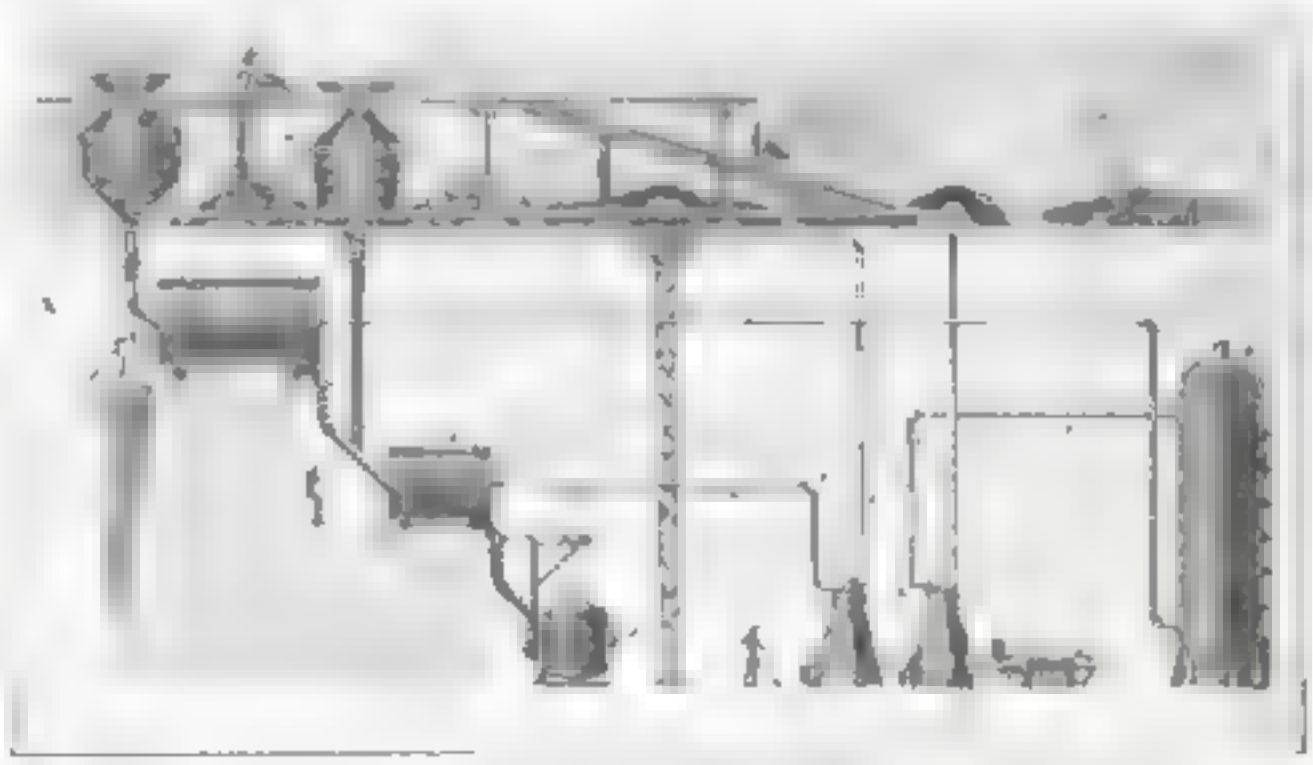
THERE has been developed and patented by Guyon F. Greenwood, of Quebec, a metallurgical apparatus for the production of iron that avoids many of the disadvantages of the blast-furnace. The essential features are the reduction of iron oxide by means of carbon with the admission of air in an electric resistance furnace and at a temperature and pressure favoring the production of carbon monoxide, the latter being used as fuel in a gas engine for generating electric energy utilized in heating the electric furnace.

The process is carried out as illustrated. The electric resistance furnace produces coke from coal, and this is fed into another furnace from a hopper and preheated by the hot exhaust gases from a gas engine. The fuel for the engine is obtained from combustible gases from the coking of the coal. The gases pass through a scrubber before they reach the engine. Ore and flux, together with the coke, are fed into the electric furnace, the ore and flux being preheated in the hopper by the heat in the exhaust gases from the gas engine. The electric furnace is maintained at a temperature of about 750° C. and at a slight vacuum without the admission of oxygen. The iron oxides are reduced without producing a slag; the result is carbon monoxide, which is used as fuel for the gas engine, which in turn drives an electric generator that supplies the furnace with current.

The raw iron is fed into the lower electric furnace, where the impurities are slagged off. A minimum amount of heat is wasted and sufficient power is developed by the gas engines to furnish the electric energy for the electric furnaces. The production of iron with this process is carried to the point of refining.

Kill Molds on Lumber by Steaming

MOLDS thrive on warm, moist wood. In a dry-kiln molds often obstruct the circulation of air through the pile. The Forest Products Laboratory found that the surest method of checking this growth is to steam the stack at 170 or 180 degrees for about an hour. This kills the mold, and at the same time the saturated air prevents such rapid surface drying as would eventually injure the wood.



These electric furnaces are used in the reduction of iron ore. The inventor of this system claims that this method will be able to compete with blast-furnaces in localities where electric energy is cheap

Counting Transfers and Cash Fares

No longer are coins counted and packed by hand. This machine does the work. There are automatic stops that lock the feeding mechanism when a predetermined amount has been reached

Dimes, nickels, pennies, and metal tickets are shaken through this machine. The tickets drop through the first screen into a tray. The next screen removes the dimes, the third the pennies, and the fourth the nickels

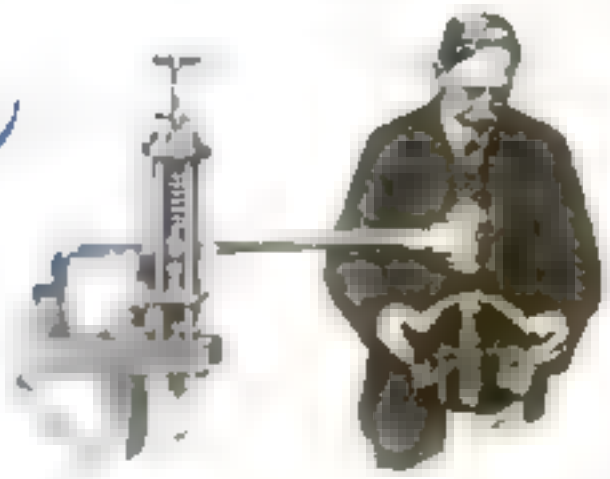
Several girls were formerly employed to operate the transfer-counting machines shown at the right. Now, however, the transfers are weighed in a lot, instead of being counted one by one it is more economical

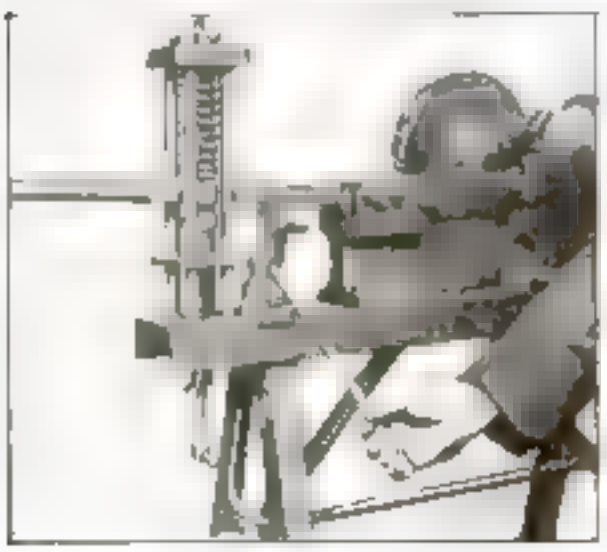
Transfers and coins are separated by means of a vacuum device that sucks up the transfers. Formerly the slow gravity system, shown above, was used. The contents of the fare box were dumped into a screen that was agitated by hand, the coins fell through, leaving the transfers

420 Hammer-Blows a Minute

A MECHANICAL hammer has been invented that can deliver as many as four hundred and twenty blows a minute when speeded up. The strength of the blows may be varied by adjusting a spring. As this spring is pulled upward, the blows become lighter; when the screw is turned down the blows become heavy

Differently shaped noses for the hammer, and anvils to correspond with them, may be used for special purposes.





In the illustration on the left the operator is shown hammering out a concave piece of metal from a flat sheet. To do this he uses a convex anvil and a concave hammer.

With skilful manipulation pieces of sheet metal may be formed into practically any shape when the proper hammers and anvils are used on the machine.

The compressed air required to drive the hammer is delivered under a comparatively low pressure. The machine may be driven for a few cents a day

Is the Population of the Earth Increasing?

SOMEBODY has reckoned that if the earth's population had increased 4½ per cent every hundred years since the birth of Christ, by now there would not be standing-room left on the globe, including all the islands. Yet England and Wales in ten years increased their population 161 per cent, and the increase in the United States has been much greater.

The earth's population at the present time is about sixteen hundred million. Different parts of the earth vary greatly in the matter of density of population. Certain portions of China, the Ganges valley, and parts of Europe are too crowded for comfort. On the other hand, large tracts of Central Asia, Russia, the Americas, Africa, and Australia could accommodate many more people.

The Turks by their religious fanaticism have caused devastation in the last five hundred years in the valley of the Danube, in Macedonia, Asia Minor, Syria, and Mesopotamia. These countries, as a result of massacre and famine, are dried-up deserts

Popular Science Monthly

How the Pyramids Would Be Built Today

Applying modern engineering methods

By **Raymond Francis Yates**

Drawings by Charles L. Morgan

NINETY million cubic feet of stone sprawled out over thirteen square acres and reaching nearly five hundred feet into the sky, makes up the tomb of the tyrant, Cheops. A hundred thousand naked slaves toiled for twenty years in the blistering Egyptian sun to build this pyramid. Hordes of dark-skinned men pulled, tugged, and hauled under the sting of the lash. Great stones moved slowly, inch by inch, foot by foot, into their place high up on the pyramid.

For centuries the sand-laden winds have pitted its face. But the miracle in stone still stands as an enduring monument to the bold engineering spirit that willed it into being. It is indeed a stubborn triumph over nature—the fulfilment of a passion for gigantic undertaking. For four thousand years the mighty shadow of this imposing mass of stone has crept across the still valley of the Nile, the red sun blazing behind it.

We can picture great masses of brown men tugging at the stubborn stones, the whip snapping at their heels and the hot desert breezes fanning their sweated brows. We can see in our mind's eye the inert stones responding reluctantly to their taut muscles. It was not a scene of wild disorder, of shrieking whistles, throbbing engines, and shouting men. It was merely the inhuman application of man-power to overcome the dead resistance of tons and tons of stone.

How Did They Do It?

How did this ancient people pile up this colossus? No one really knows. Herodotus and Diodorus, who obtained their information from ancient Egyptian priests, have given us a credible description. Many modern theories are modifications of the engineering data disclosed by these writers.

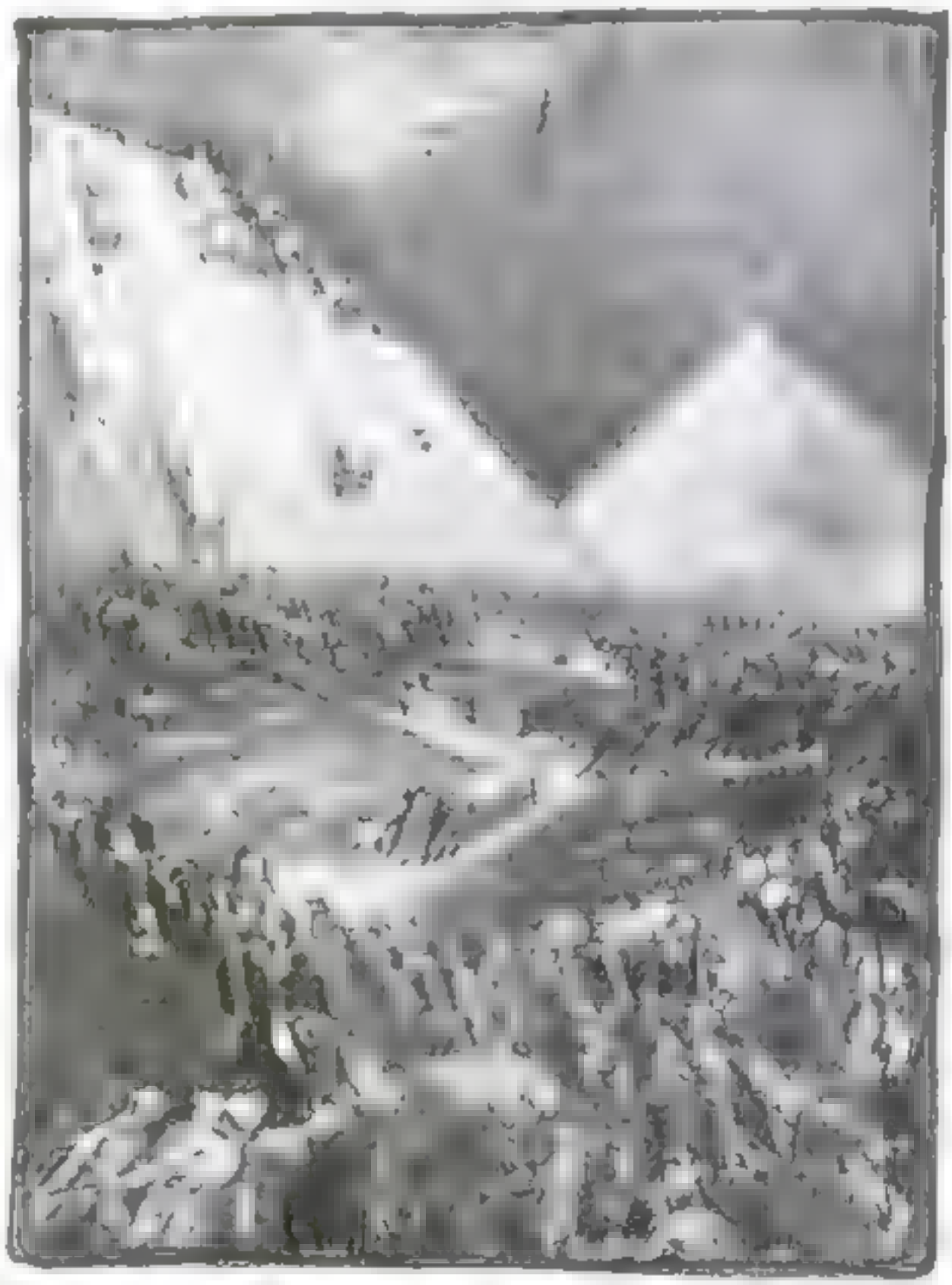
Limestone was the principle material used. This was quarried about twelve miles from the site of Cheops' pyramid. It was cut in large blocks by an ingenious application of one of the most elementary laws of physics—that of cubical expansion. A deep groove was first cut into the stone by the use of tools that are today ridiculously crude. Wedges of soft wood were then forced into these grooves. Boiling water poured on the wedges caused them to expand and this expansion broke off a huge block of limestone. This wearisome process was repeated thousands of times by slaves. The huge stones, obtained with so much trouble, were then loaded on sledges and hauled away to the building-site.

Historians have long believed that these ancient builders used a long earthen ramp or incline up which the stones were dragged by thousands of slaves. This ramp was added to as the work progressed, gradually increasing in height and length. When the last stone capped the pyramid, the ramp must have been about five hundred feet in height and several miles in length. To build such a ramp has caused engineers to wonder if the Egyptians may not have used a simpler method

A modern engineer, who recently investigated this subject, has rejected the ramp theory as being utterly impractical. He asks, "Why should the Egyptians have thrown up a huge earth mountain to build another smaller mountain of stone?" He suggests that the incline of the pyramid itself was used in hoisting the stones in place.

Details of Construction

This method will be better understood if a brief account is given of the general construction of the pyramids.



A laboring mass swarming like ants at the base of a half finished hill. A theory has been advanced that the Egyptians finished the outside of the pyramids as the work progressed. Huge stones were drawn up the sides by ropes pulled by thousands of men

The stones were placed in layers, step fashion. The steps were filled in with a triangular-shaped piece of granite, leaving a perfectly smooth incline. Were the blocks of stone hauled up this incline with long ropes pulled by slaves? This is the modern engineer's hypothesis.

But how should we build the pyramids today?

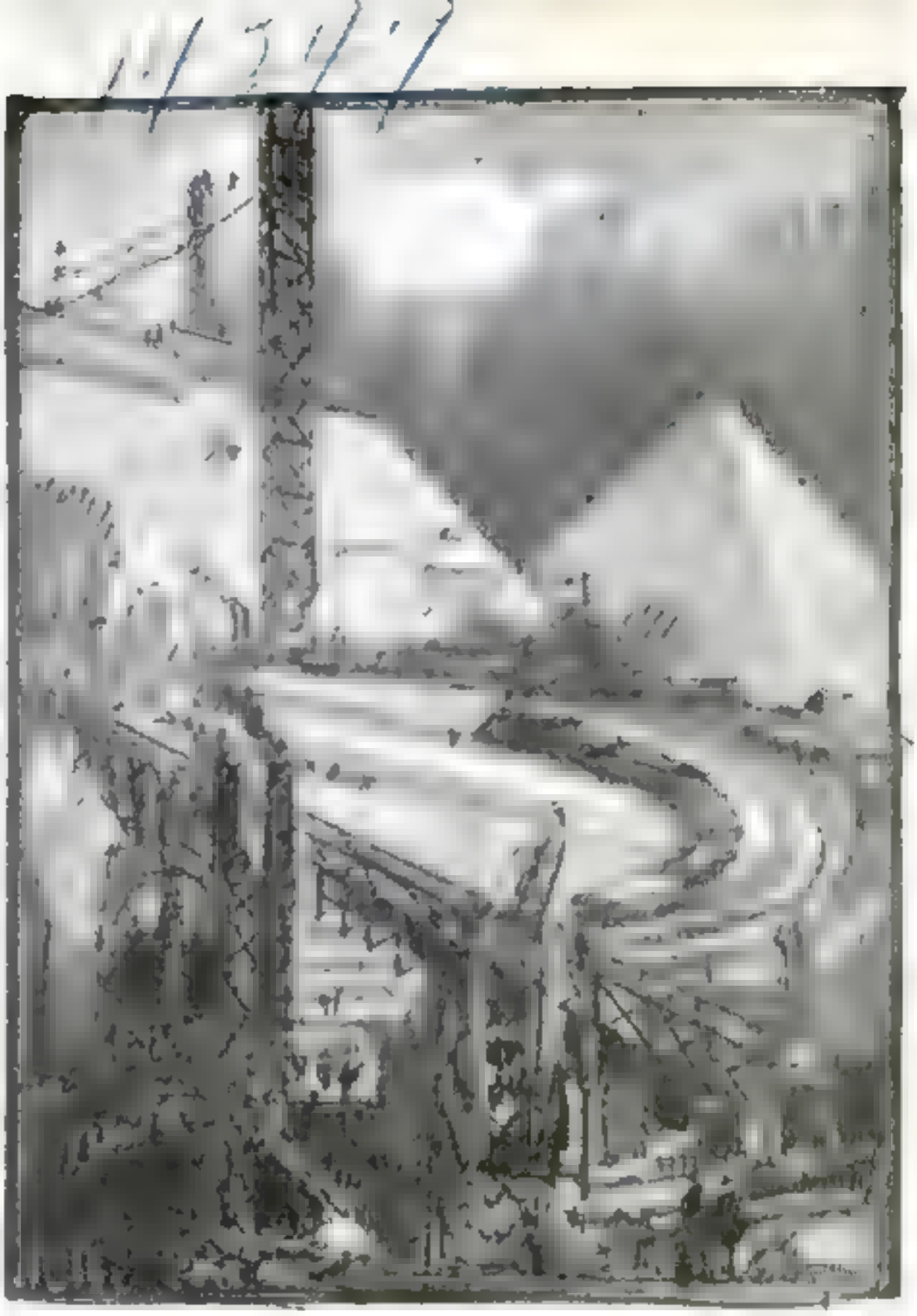
In lower Broadway, New York, an ironworker foreman steps to the edge of the structure, waves his hand to an engine operator twenty stories below, and a five-ton girder mounts skyward. Imprisoned steam or a current surging through an electric motor would have literally tossed the limestone blocks of the pyramids into the air.

We Should Use Concrete

With modern devices we could build a pyramid in a year. There is no doubt that concrete would be used in its construction. This would take the place of Egyptian limestone. An enormous concrete-mixing plant would be erected. This would be capable of handling thousands of tons of concrete a day. A great steel tower, or several of them, would then be built. Fresh concrete would be rushed to these by a multitude of bucket conveyors from the concrete-mixing plant. The concrete would be whisked to the top of the towers and from this point it would flow down like water to the walls. Unending streams of concrete would run down for months, and up, up, up the great pile would go. The interior of the pyramid might be filled with broken stone or sand. The steps outside the wall could be filled with triangular pieces of granite without engineering difficulty of any kind.

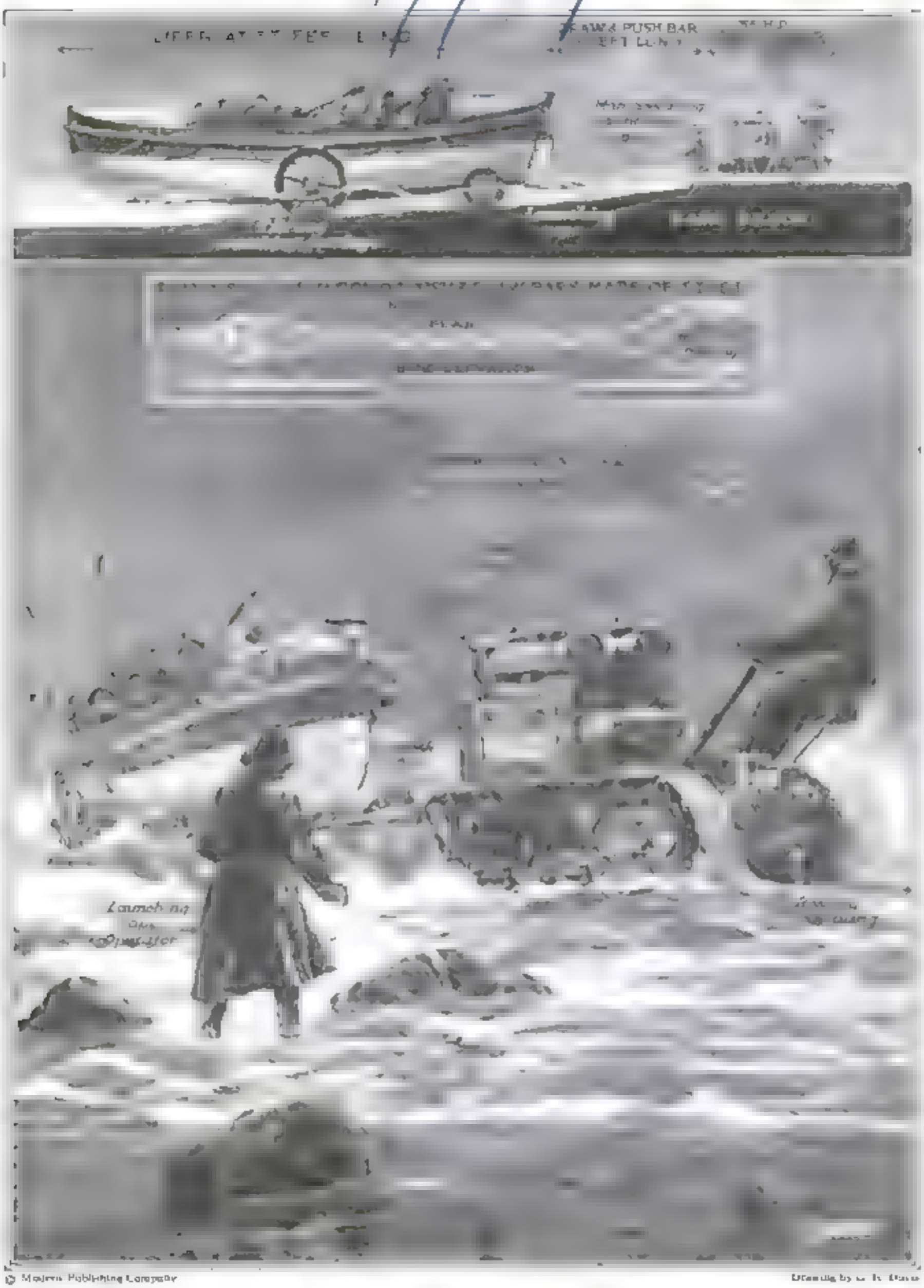
Given a year's time, only one thousand men would be necessary to build a pyramid today. They would probably receive a wage averaging $4.00 a day. This would total $1,200,000. The cost of labor in the building of the pyramid of Cheops totaled only $200,000. This is what it cost to feed the one hundred thousand slaves for a period of twenty years. Times have changed. Today there would be no continuous period of unremitting labor as in the past. When the pyramids were built, the slaves followed out an unmerciful grind from early morning until the sun had set. Today machinery would do all the hard work.

All the forces we control would figure in the construction of the pyramids today. Electricity, chemistry, and steam would take the lead. Every unit of our engineering knowledge would take its part. We have gained invaluable experience in the carrying out of great projects, many of which are as marvelous as the pyramids.



Today, provided with modern equipment, a thousand men could build in one year the pyramid that took a hundred thousand men twenty years to build construction would be largely a matter of mixing, conveying, and pouring concrete

This illustrates one of the older theories of the construction used by the Egyptians. Some engineers believe that they built long earthen ramps and pulled the granite and limestone blocks up the incline. Such a ramp would have been several miles long. Traces of ramps are left about the smaller pyramids, but none near the larger ones



Drawing by C. H. Davis

Launching a Life-Boat by Tractor

It was at the Hunstanton station of the Royal National Lifeboat Institution in England that the idea of using the caterpillar tractor to launch life-boats was evolved with such success that now twenty English life-boats are being provided with this means of launching.

The tractor is driven by a 35-horsepower gasoline engine, and the life-boat on its carriage is connected with the tractor by a rigid steel pole. A water-tight casing protects the vital parts of the engine when it is submerged in four feet of water.

When the tractor, drawing the life-boat, reaches the water's edge, it is uncoupled. It then passes around to the stern of the boat, and by a special arrangement of ropes and pulleys launches the life-boat. Four men and one tractor can do the work ordinarily accomplished by ten horses and ten men.

Launching Life-Boats by Caterpillar Tractors

Modern methods save time where it counts most

By P. J. Risdon

English correspondent for the Popular Science Monthly

STANDING on the seashore on a fine day, it is difficult to believe that a great storm is approaching from beyond the horizon: that in a few hours great waves will be racing in with a howling tempest of wind, breaking with almost irresistible force, flinging tons of water on high, and sweeping the shore in swirling masses of foam.

But all this is known at the life-boat station, where the storm signal is hoisted. As it grows dark the wind increases to a gale, and watchers on shore are at last startled by the bursting of a colored rocket out at sea, fired by a ship in distress. That summons must be obeyed—and obeyed quickly, for there are human lives at stake.

Rapidly members of the crew make for the boat-house. The call goes forth for horses—ten powerful creatures. Then occurs the almost invariable delay of collecting them from local stables—delay that may result in the bravest efforts being made too late.

At last the horses are harnessed to the under carriage on which the life-boat is mounted, and proceed to draw their seven-ton load down to the water's edge. Now comes the task of hauling it into the seething breakers a procedure often resulting in drowning or such injury as to necessitate the destruction of valuable animals—small wonder, when one thinks of the poor brutes battling with the waves, slipping on seaweed-covered rocks and boulders, and floundering in deep holes.

It seems strange that only recently has the idea of applying motor traction to the launching of life-boats been developed with practical results. The honor for the development is due to the engineers of the Royal National Lifeboat Institution of England—whose efforts have resulted in successful trials of the caterpillar tractor illustrated on the opposite page. This tractor is driven by a 35-horsepower gasoline engine. Hunstanton, Norfolk, where several varieties of beach exist, was selected for the trials. The first tests were something like those to which the "tanks" used in the late war were subjected, and included the negotiation of sand-dunes and the mounting of vertical faces of rock.

The life-boat and carriage were secured to the tractor, which made light work of its task, drawing its load across the sand at a speed of six miles an hour. As will be seen, the connecting attachment is a rigid braced steel pole or strut, hinged at one end to the tractor and at the other end to the boat-carriage.

When the first effort at tractor launching was made, the carburetor and magneto of the engine were not properly protected, with the result that the engine stopped and the mechanic and another man were marooned on the submerged tractor, and had themselves to be rescued! Subsequently a water-tight casing was provided effectually to protect the vital parts of the engine when submerged in four feet of water.

The *modus operandi* is as follows: The tractor draws the boat and carriage down to the water's edge. It is then uncoupled, when it passes round to the stern of the life-boat and pushes the carriage out into the water. By means of a special arrangement of ropes and pulleys the tractor then hauls the life-boat off the carriage and launches it.

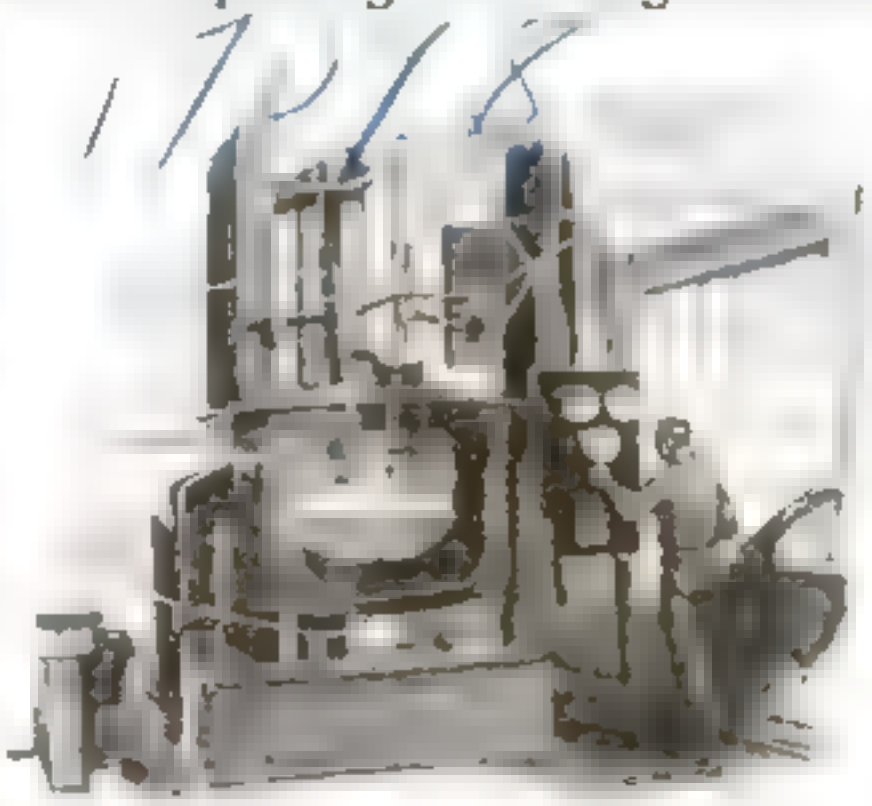
Twenty life-boats in England are being provided with this practical device, which ought soon to supersede the antiquated method of horse launching, since four men and one tractor can do the work of ten horses and ten men far more rapidly, safely, and efficiently.

How a Repelling Arc Regulates Itself

THE inventor of a new electric furnace has employed a principle that makes his device unique. A repelling arc is used. The layman can understand the principle by considering the electric arc light used to illuminate city streets.

Here an electric current is caused to flow across an air-gap formed by two carbon electrodes. The carbons are first brought together and then separated. When they are brought together a spark is produced, and the heat of this spark causes carbon vapor to fill the gap when the carbons are brought out of contact. Carbon vapor is a good conductor of the electric current, and the current continues to flow across the gap, generating terrific heat and a great amount of light.

This furnace operates on practically the same principle. The electrodes or the carbons, however, are not mounted in the same manner. They are balanced on knife-edges, with counterweights attached to the upper ends.

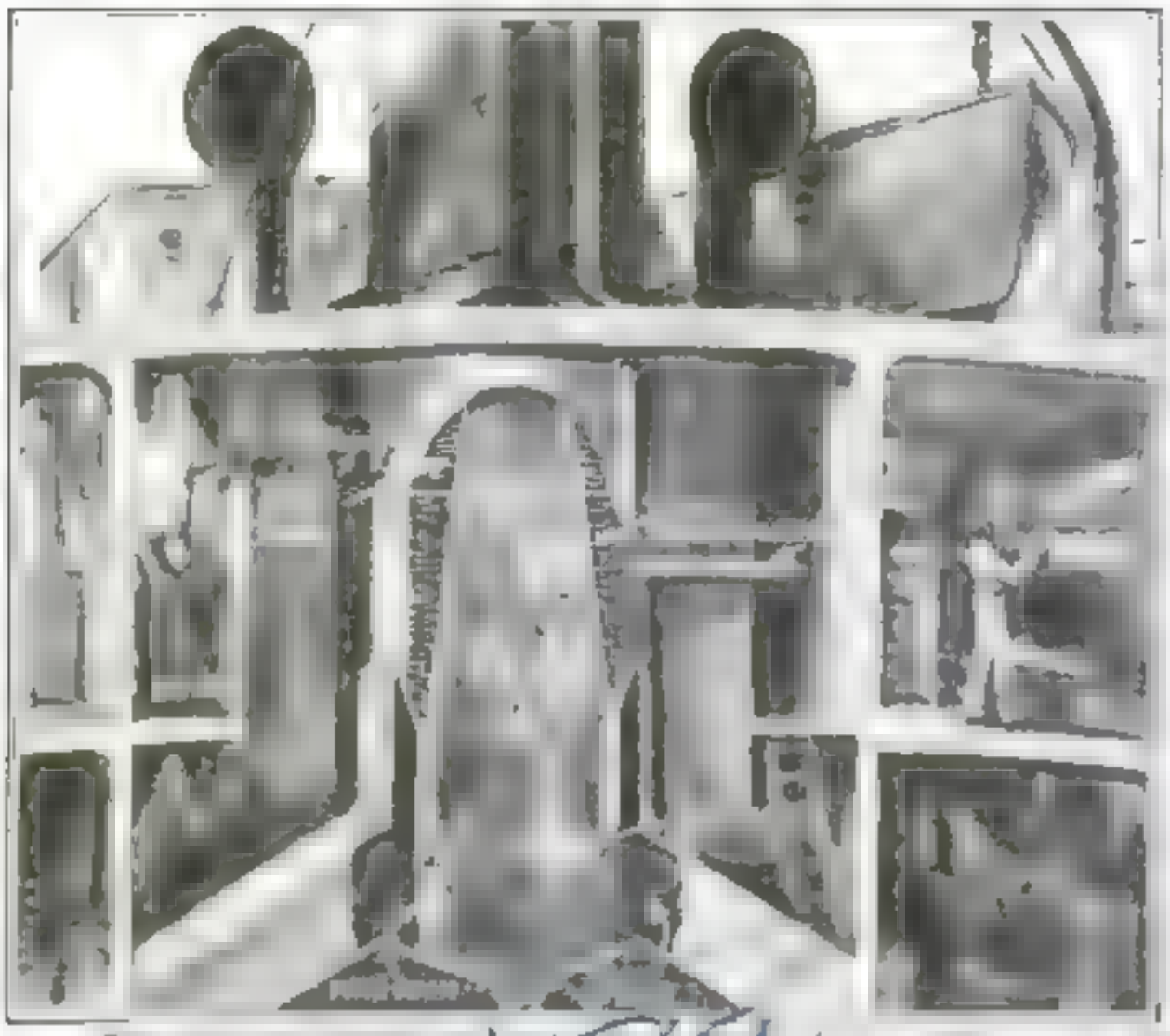


The electric furnace with repelling electrodes. When no current is flowing, the electrodes come together. When the current is turned on, the electrodes repel each other and an arc is "drawn" between them

When no current is flowing through the furnace, the electrodes come together. When the current is turned on, the electrodes repel each other and they fly apart, an electric arc appearing between them. The repelling of the electrodes is caused by the "flow forces" of the electric current.

The arc is self-regulating, since an increase in the amount of current flowing across the arc will cause an increase in the flow forces, which in turn move the electrodes farther apart.

By adjusting the weights on the ends of the electrodes the arc may be regulated within wide limits. This furnace has been found especially useful in the non-ferrous iron industry.



[illegible] of water, warm [illegible] to the sea

Giving the Smoke a Shower-Bath

IN order to do away with smoke from ships' funnels, an Italian inventor has an apparatus consisting of a slightly conical, doubled-walled shaft, placed in the lower part of the funnel.

The space between the walls is divided into two compartments. Warm water from the condenser is conducted into the lower compartment, while the upper one is supplied with cold water furnished from a force-pump. The smoke enters the shaft at its lower end and passes through a shower of water, warm in the lower part and becoming cold in the upper part. This causes a gradual cooling of the [illegible]

The water enters the shaft through small openings in the side, and also forms a ring or curtain at the lower end through which the smoke from the furnace passes before it can reach the funnel.

The water is collected into a conical basin and is conducted to the sea.

Another Tractor to Lighten Freight-Yard Work

ONE sheet of steel no larger than a large sheet of cardboard, and not much thicker, can be moved about by one man without much trouble. But how about fifty of these stacked together?

The old way to unload a freight car [illegible] use a truck hauled by a number of men. Now the small tractor does the work in a simpler and easier manner. It does away with all the hard tugging and the straining of muscles. With greater [illegible] a load of sheet [illegible] house floor, and [illegible] the next load.

[illegible] go there were only [illegible] plates of steel produced in this country, while [illegible] are more than seven [illegible]

[illegible] of the tremendous amount of energy required to accomplish the moving of so many sheets and plates of steel! No wonder that an easier way had to be found.

With the greatest ease the little tractor pulls a truckload of steel sheets

When and How a Ship Is Arrested

DID you know that if a ship's debts are not paid the ship can be arrested? Even though it is not actually the ship's fault, a writ is nailed to her mast, a watchman is put on board, and the ship is not allowed to move until her debts are paid.

The creditor must, however, be sure of his case; if not, the ship's owner may sue him for delay and loss of use. Therefore the usual procedure is to send the owner several warnings, as by watching the shipping-lists the creditor can follow a ship's movements. If the owner makes no response, the warrant for arrest is issued, and the ship must submit to her fate.

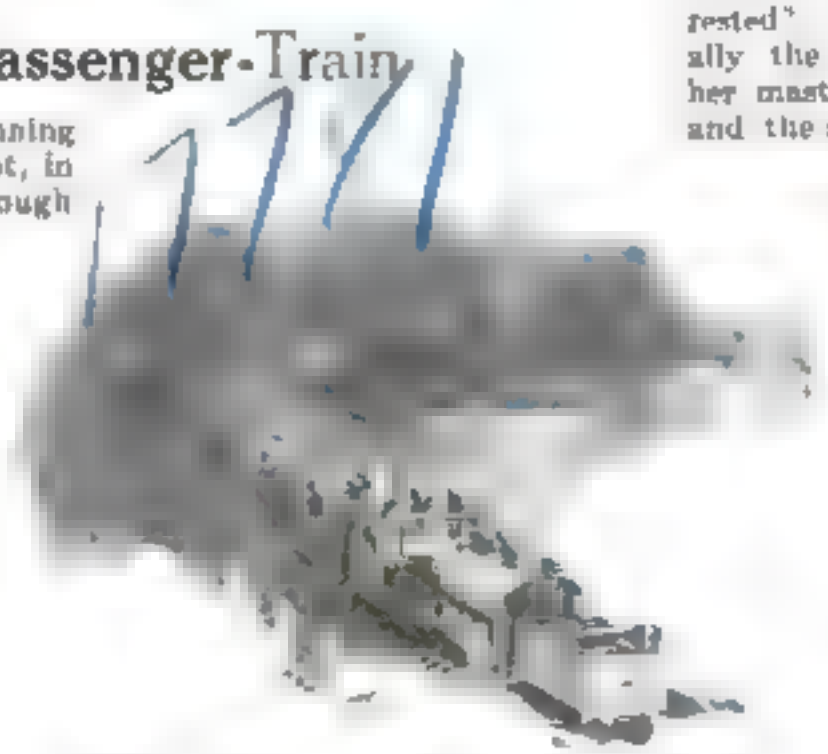
There are on record cases in which crews have been compelled to order the arrest of their own ship at the end of a voyage in order to collect their wages.

Smallest Passenger-Train

THE tiny Eskdale railroad, running between Ravenglass and Boot, in England, is not a toy railroad, though it looks like one. It was originally constructed for mineral traffic, but is now much used by sightseers in the lake district, and from Boot many delightful excursions may be made.

The gage is only fifteen inches, and the rails, designed for heavy traffic, weigh forty pounds a yard. The little locomotives are a triumph of engineering skill. The boiler is six feet six inches long, the working steam pressure 130 pounds.

There are two types of cars. One, for summer use, is roofless and the other is enclosed.



Built originally to carry minerals, this tiny railroad is strongly made; it is now patronized by sightseers

Music in the Zoo

THE old saying that music has charms to soothe the savage breast may be true in some cases, but a recent demonstration at the Central Park menagerie in New York city failed to prove its truth in the case of caged animals.

When some musicians, playing wind and string instruments, appeared before the cages, the animals sat up and took notice at first. Then most of them became restless. The large crowd of onlookers may have had something to do with their excitement, as well as the noisy jazz, which seemed to arouse the animals.

According to Dr. E. L. Scott, of the Department of Physiology of Columbia University, one of the scientists present at the experimental demonstration, the results as a whole did not indicate that the musical noise had any very pronounced effect, although the behavior of some of the animals was unusual

The polar bear exhibited astonishment when the trombone and clarinet began a duet. The bear at first sat up in the attitude of a dog when it begins to howl. Its jaws opened, and there was a nervous, trembling movement of the cheek muscles, and he looked as if he would like to howl if he could. Instead, he stood up and began to sway excitedly from side to side in a curious kind of dance A small tame wolf in an adjoining cage at first ran into its den under cover, then came out and ran wildly around, panic-stricken.

The elephant was the most indifferent of all the animals. He was perhaps sagacious enough to know at once that the whole thing was a joke

That a dog is keenly sensitive to music is well known, but what are the emotions aroused? Does it howl for joy or for pain? Are some primitive emotions wakened that touch its racial memory and bring back the mystical terror of the wilderness, the same emotions that make a wolf howl in the wistful loneliness of the moonlight?

These are questions that future experiments may help to solve.

Playing music had little visible effect on this elephant, who accepted sweet strains and jazz with stolid indifference

Here is a small hand propelled sowing-machine that can be used to plant one, two, or three rows with little effort

A Machine for Planting Small Gardens

WHEN seeds are to be planted in beds or rows, it saves time to use a sowing-machine. The illustration shows a type that may be used for planting in one row or in several parallel rows.

It consists of a container divided into compartments. Each compartment has an opening at the bottom, the size of which can be regulated according to the size and quantity of the seeds.

The container rests on spiked wheels and is pushed by means of a handle.

Lifting and Weighing at One Operation

SHOWN [illegible] load [illegible] merchan[illegible] weight, [illegible] weighing has alw[illegible] problem [illegible] here sho[illegible] load h[illegible] and we[illegible] the same [illegible]

This [illegible] the cra[illegible] then a[illegible] that bin is the goods together In this way the lifting and the weighing are done at the same time. While the load is being placed on the freight-car a clerk jots down the weights.

Each scale is equipped with a tare beam that automatically deducts the weight of chains, hooks, boxes, and the large lifting electromagnets.

By attaching this big scale to the crane that lifts the load to the freight-car, the goods can be weighed while being loaded

Part of a Rib for a Nose

RECENTLY an operation was performed on a man whose nose had been so injured that he was unable to breathe properly.

First the broken portion of bridge bone that caused the obstruction in the nose was removed. The next step was to cut a bit of bone from one of the man's left ribs, and to insert it in place of the bridge that had been removed.

When the physicians had completed the operation, the patient's appearance was so changed, and so much for the better, as to make him almost unrecognizable. He could breathe perfectly, and his health was therefore improved. Altogether the operation was a great success.

Discovered: a New Phenomenon of Electrical Attraction

It will lead to interesting industrial developments

By Alfred Gradenwitz

A NEW electrical phenomenon of attraction has been discovered by two young Danish engineers, A. Johnsen and K. Rahbek. It is a discovery that will eventually lead to new commercial and industrial developments, since it has been found possible to apply the phenomenon.

At present we are familiar with two forces of attraction that are electrical in nature. We have magnetic attraction and electrostatic attraction.

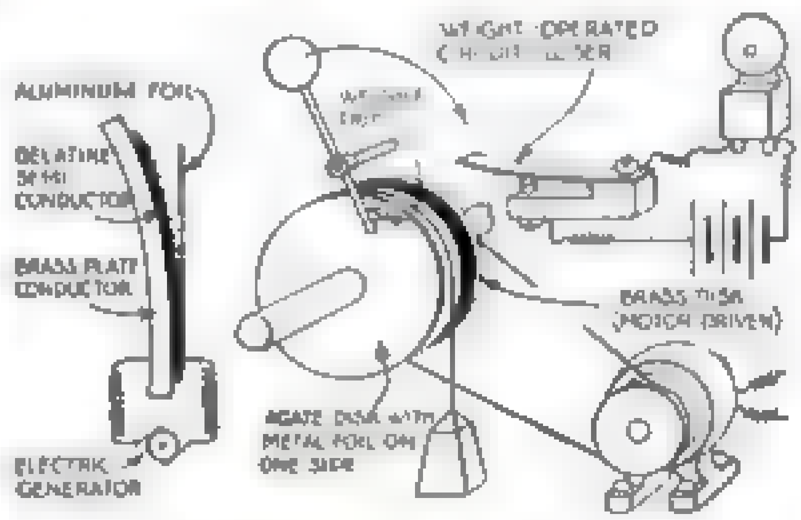
Let us imagine (the illustration in the center of the page will help us) that we have a slightly curved sheet of metal. This metal will be covered on one side with a semi-conducting substance, such as gelatine. Close to the surface of the gelatine another flexible piece of sheet metal is arranged. The terminals of a 440-volt generator are connected with the metal plates. The one that is not in actual contact with the gelatine (in this case the aluminum foil) will be drawn toward the gelatine with considerable force. The passage of an infinitesimal fraction of an ampere from plate to plate through the gelatine will cause this attraction. The action ceases when the current is turned off. This attraction is the new force discovered by the Danish engineers.

How the New Force Is Applied

A number of semi-conducting substances may be used in place of the gelatine. Agate and slate have been used successfully. The diagram shows an agate disk that forms part of a special electric relay. This may perform any mechanical function when the current in an electrical circuit (of which it forms a part) is either turned on or off. When the current is on the metal foil will be attracted to the agate disk and it will turn with it. When the current is turned off the attraction will cease and the agate disk will separate itself from the metal foil. The arrangement is really a clutch controlled by this new force of attraction.

A telephone receiver has been developed by the use of this new principle. A constantly rotating metal core is covered with gelatine. A thin metal band is pulled tightly over this. One end of the sheet-metal band is connected with springs that keep it taut, and the opposite end is connected by a thin wire with a diaphragm mounted in a receiver. The fluctuating current from a telephone transmitter is allowed to pass through the gelatine on the cylinder. The attraction between the gelatine and the metal band varies with the current. The springs are constantly pulling the metal in one direction, while the attraction between the band and the revolving drum (that varies with the voice currents) is trying to pull it in the opposite direction. This causes the metal band to vibrate in sympathy with the voice currents, and the voice will be reproduced at the diaphragm.

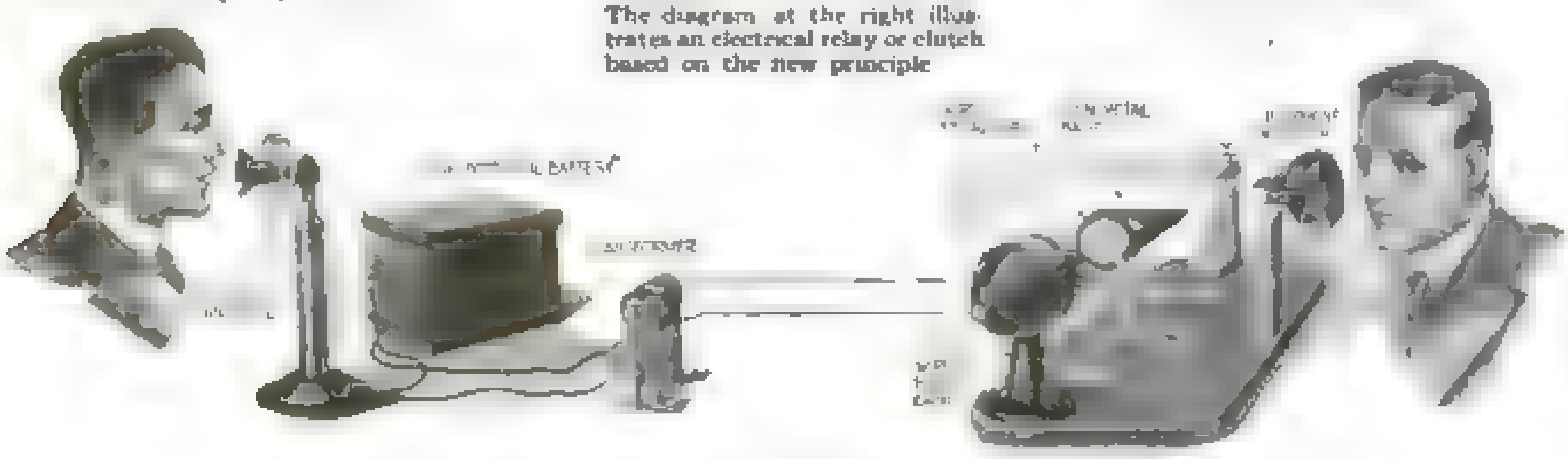
Messrs. A. Johnsen and K. Rahbek, the young Danish scientists who discovered the new force of electrical attraction described in this article



The arrangement used for the demonstration of the new attraction is shown at the left. The diagram at the right illustrates an electrical relay or clutch based on the new principle

Only a Small Current Needed

The intensity of this new force of attraction is tremendous, considering the small amount of current necessary. The passage of 1/1,000,000 amperes from plate to plate through the gelatine will cause an attraction sufficient in intensity to overcome a weight of nearly two and one quarter pounds. The new phenomenon may be better understood by reference to the attraction that exists between the plates of an electrostatic condenser. These are drawn toward each other with a force that increases inversely as the square of the distance. Reducing the distance one third increases the force nine times. The same law appears to hold true for this newly discovered attraction.



Here is the new telephone receiver that operates on the newly discovered principle of electrical attraction. A metal band is pulled taut over a gelatine- or agate-covered revolving cylinder. The attraction between the cylinder and the band is caused to fluctuate by the varying intensity of the voice currents

Shipments that Write Their Adventures

How the barograph can be used in business

By John Edwin Hogg

WHEN a barograph is spoken of, most of us think only of a delicate little instrument that is used for recording altitude. A barograph is nothing but a recording barometer. Recent experiments have revealed that it is possible to use the barograph as an aid to commerce in the production of records of every form of travel by land and air, computing the average time consumed in any given journey, and tracing the movements of delicate and costly shipments.

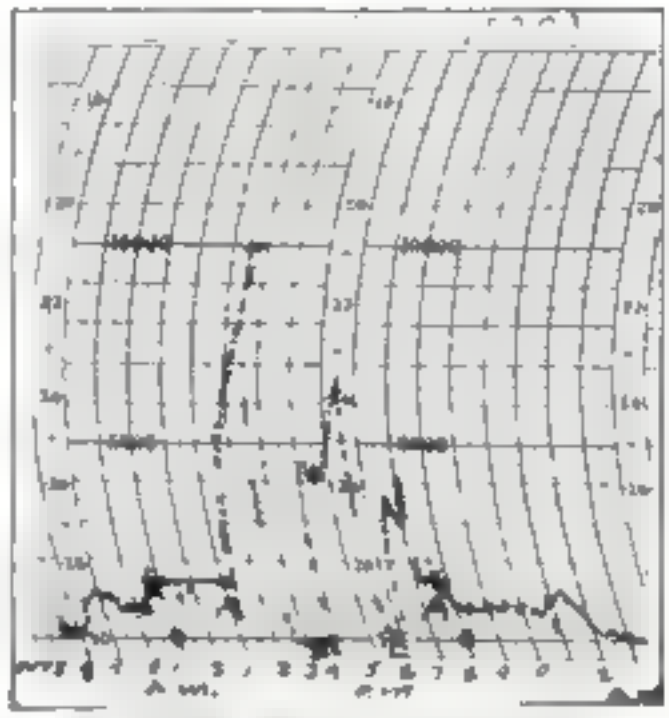
The range of the commercial applications of the barograph has been widened by a series of experiments conducted by Dr. Ford A. Carpenter, of the Department of Meteorology and Aeronautics of the Los Angeles Chamber of Commerce. Numerous barograph records have been made covering trips by airplane, automobile, horseback, afoot, by train, interurban electric, free balloon, dirigible, and almost every other practicable medium by which human beings and merchandise travel on land and in the air

Barograph records have been worked out to such a degree of accuracy that a glance at them suffices to tell just what method of travel was used. Similar records, if applied to shipments of costly merchandise, or to merchandise where the element of time consumed in transit is of great importance, will show us just how the shipments were handled

Twenty express packages might be sent out, each consigned to a different destination, and to be forwarded by different modes of travel. If a barograph were placed in each package, and the records compared after reaching the destinations, we could tell instantly which parcel traveled by airplane, which one by train, by motor-stage, or other conveyance.

Time and Elevation Recorded

The elements with which the barograph deals are merely those of time and elevation. The spaces between the vertical lines of the record represent time, and the spaces between the horizontal lines represent elevation. The clock mechanism may be calibrated to operate for twenty-four hours or more. Let us suppose that we wish to record the movement of so valuable an express shipment as a motion-picture film. A barograph is set in motion, and wrapped with the package in New York. The



A barograph record. Spaces between the vertical lines are for the time record, and those between the horizontal lines for elevation. A clock mechanism controls the length of time for its operation, which may be twenty four hours or longer

mechanical record of its travels begins at once. If the package lies in the express office for half an hour before it is taken to the train, the fact will be registered. The barograph places a dot on the chart every two minutes. During the period that the shipment remains stationary fifteen dots will be placed in a horizontal line across the paper, because during the interval of half an hour the instrument will register a dot every other minute at a stationary elevation, which will be shown as sixty feet—assuming that sixty feet is the elevation above the sea of the New York express office.

A barograph is enclosed with each package sent on an express journey, and the instrument keeps a record of its travels, which is read when the package is opened

Courtesy San Diego Union

The word "barograph" immediately reminds one of aviators; but a barograph is nothing but a recording barometer, and Dr. Ford A. Carpenter of Los Angeles, conceived the idea of applying it to industry

If the package is then put in a wagon to go to the railroad station, the instrument will immediately begin registering time with relation to the varying elevations that the wagon is driven over

The speed with which the dots appear with relation to the changes of elevation indicate whether the package traveled in a slow-moving wagon or a motor-truck. If the package then lies in the railroad station for half an hour, the barograph will record another thirty-minute period at a stationary elevation.

It Even Keeps Tab on the Trains!

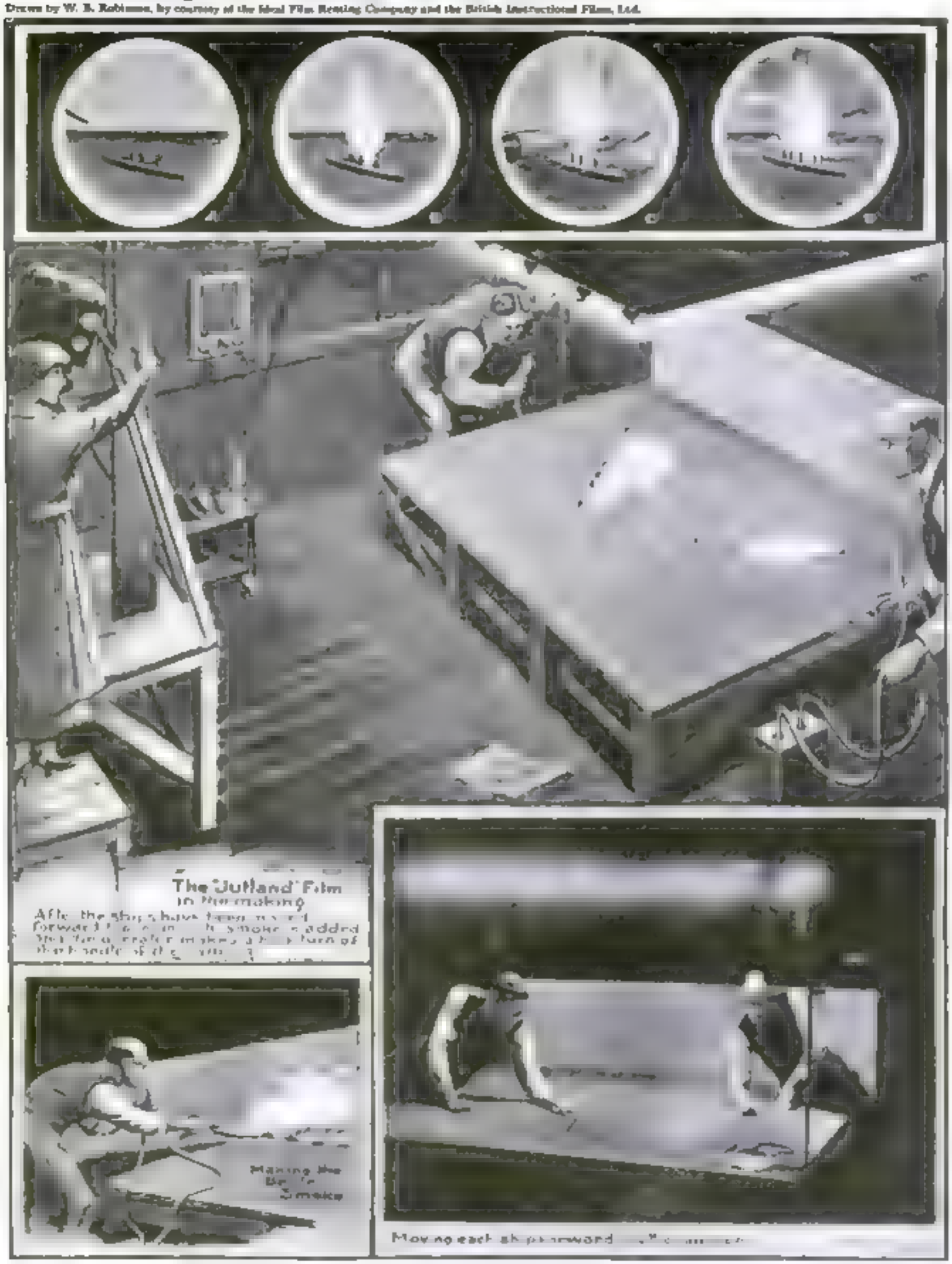
Just as soon as the parcel is under way in the express car, the barograph begins registering time in relation to railroad elevations.

At the end of the journey we have simply to compare the barograph record with the railroad time-table to discover whether the train was on time when it reached its destination. Similarly, if the train was an hour late at Buffalo, but arrived at Detroit on time, that fact will be clearly shown on the chart.

Since it is safe to assume that no two cities in which the train stopped will have identically the same elevation, and that the barograph has recorded the length of time of the stops, and the contours of the earth between stops, there is no possibility of mistaking the identity of the cities represented by the stops when reading the chart. If the record is taken between points where the earth's contour is rugged, the chart will show numerous prominent and sudden changes of elevation.

Staging the Jutland Naval Battle for the "Movies"

Drawn by W. B. Robinson, by courtesy of the Ideal Film Renting Company and the British Instructional Films, Ltd.



THE naval battle of Jutland was one of the few great events of the war in which the "movie" man did not figure. A moving picture producer of England decided to re-stage the battle with the use of tiny models. It was a tremendous task, since every detail of the movements of the German and English fleets had to be carried out.

Mathematicians were called in, and every movement made by the models had to be carefully calculated. Each boat was moved only a sixteenth of an inch at a time. A certain maneuver of the English fleet required eighty thousand movements of the vessels by hand. Only sixty feet of film was required to record this movement, which took several days to carry out.

Tiny chemical pellets were used to get the effect of a burning vessel. These were set off with a match. The gunfire was produced by blowing smoke through small tubes. The board upon which the battle was staged measured eight feet square. Each of the tiny models employed was scaled down to the proper size. The camera used in taking the pictures was placed above the "battle" to get the effect of an aerial view.

Teaching Tricks to a Dog

It's easy, but it requires infinite patience

By Latimer J. Wilson

ROY RUSH, of the Ringling Brothers and Barnum & Bailey Circus, can train a dog or a monkey in six weeks. In the "biggest show on earth" the audience sees a fluffy little dog balancing himself upright on a slack-rope. The dog puts his fore feet upon the rope, then mounts it with his hind feet, and for an instant balances himself on all fours. At a word from his master he stands upright, cleverly keeping his balance on the swaying rope. How did he learn this trick?

First he was taught to stand upright on the floor an easy trick taught to many dogs. Then he was made to stand upright on a large rope stretched upon the floor.

Rush holds a thin light cane and speaks to the animal in a firm tone, but without a trace of anger. A display of anger spoils the work of days; for dogs and monkeys are very high-strung, temperamental creatures, quickly responsive to the moods of people. When the dog had learned to stand up on the rope on the floor, the rope was elevated a short distance. Great patience was now required to keep him balanced. He soon found it more difficult to stand upright on the slack-rope than on a rope laid on the ground. After half an hour of failures the dog for a moment succeeded. Then Rush patted him. Occasionally after a successful exhibition Rush gave the dog a small piece of meat, a lump of sugar, or something as a reward. In the case of Jocko, a big baboon, the reward was literally a "chew of tobacco."

"How did you teach Joe [a monkey] to ride a bicycle?" I asked Rush.

"Well, Joe was first taught to sit upright in a small chair. Then he was taught to sit upright in a little tricycle, his feet tied to the pedals. As the tricycle was pushed around the room, Joe learned the art of pedaling. Next he was placed on a small bicycle, a guide-rope attached to the collar around his neck. This guide-rope, which I held, kept Joe moving in a circle. After a few mishaps the monkey found that he could stay aboard by balancing himself, and that it was easier to keep his balance going around in a circle than in going straight. Finally the rope was removed and Joe rode around by himself.

Three stakes painted white were planted in a row, and Joe was piloted by the guide-rope so that he would circle around one after another.

"Joe! Joe! Joe!" commanded Rush, puding gently on the rope on the side he wished the monkey to travel. When the guide-rope was removed, he still gave the same commands, simply the word "Joe!" firmly uttered. He always stood in front and on the side that indicated the direction to be followed. Finally Rush could stand in one spot and give the commands and the monkey would obey. He remembered what was wanted of him.

Dogs and monkeys can be taught tricks when they are about a year old. The trainer wanted to teach Joe how to juggle plates. First, Rush sat him on top of a tall stand and leashed the collar-rope so that Joe could not get very far away. Then four wooden blocks about an inch thick and five inches long by three inches wide were tossed at Joe one after another. At first the monkey warded them off to prevent them from striking his face. Rush continually commanded, "Joe—Joe," each time throwing a block. At last Joe caught one of them, and Rush patted him affectionately on the head. Within half an hour, after Rush had made about forty trips picking up the blocks, Joe caught all four of them. The first attempt to teach him to juggle was declared finished. Joe was patted and kind things were said to him. Then he was given a raw sweet

A dog, unlike a cat does not naturally climb a ladder the dog here shown was taught the feat by degrees

Monkeys and dogs are high strung and temperamental. Their trainers must never show any trace of anger

Each dog was taught his part of this ensemble trick then the four were brought together for their act

potato. At this he grunted loud approval and went into his cage to enjoy it.

There is no use telling a dog or a monkey in long sentences what is wanted of him. Calling merely his name, but in a tone of voice that demands obedience, is what counts. The tone of voice carries more weight than the meaning of what is said. The trainer should know from the start just what he wants his charge to do. Any uncertainty in his own mind only confuses the creature. Rapid success in training depends upon making the animal understand what is wanted by repetition until he gets it firmly fixed in his head. Later it becomes merely a matter of memory and association. A good performance is associated with reward; a bad one receives censure in tones that are unmistakable. But there is no inhumane treatment; no exhibition of bad temper.

Monkeys respond quickly to the instinct of self-preservation. Joe was riding his bicycle in a wide curve, and realized that collision with a box near the wall was imminent. As he approached the box he threw out his arm and warded off the blow of impact.

In this particular the monkey differs from the clumsy bear. A bear would have ridden full force into the wall without any attempt to save himself

It required days of endeavor to perfect this act. After each successful step the trainer rewards the animals

Would you like to teach your dog a few tricks? Watch the dog- and monkey-trainer who has had a score or more years' experience in training small animals. There is just one thing that is essential, and that is *patience*, without that, all hope of success is futile.

Valuable Fertilizer Found in Austrian Caves

AUSTRIA is a country of many caves. It has been discovered that in many of the caves among the Salzburg Alps, especially the Dachstein and Tennen ranges, the floors were piled high with natural fertilizer

The origin of these piles of organic matter is ascribed to the remains of the bones and excrement of predatory animals most of which are covered with deep layers hundreds of years old of bat guano. Beside these masses of enormously rich fertilizer the earth beneath them is strongly impregnated with a readily soluble phosphoric acid. An expert declares that "the exploitation of even a small fraction of this fertilizer should produce material of sufficient value to cover Austria's entire war debt"

The Austrian government has passed a law declaring these masses of guano to belong to the government. Unfortunately, this material, in spite of its richness, cannot be delivered immediately to the farmers whose lands are crying for food, since it contains certain substances that are injurious to plant life. Chemists and physicists must study the deposits to determine the best method of extracting the useful elements.

Photography Comes to the Aid of the Tailor

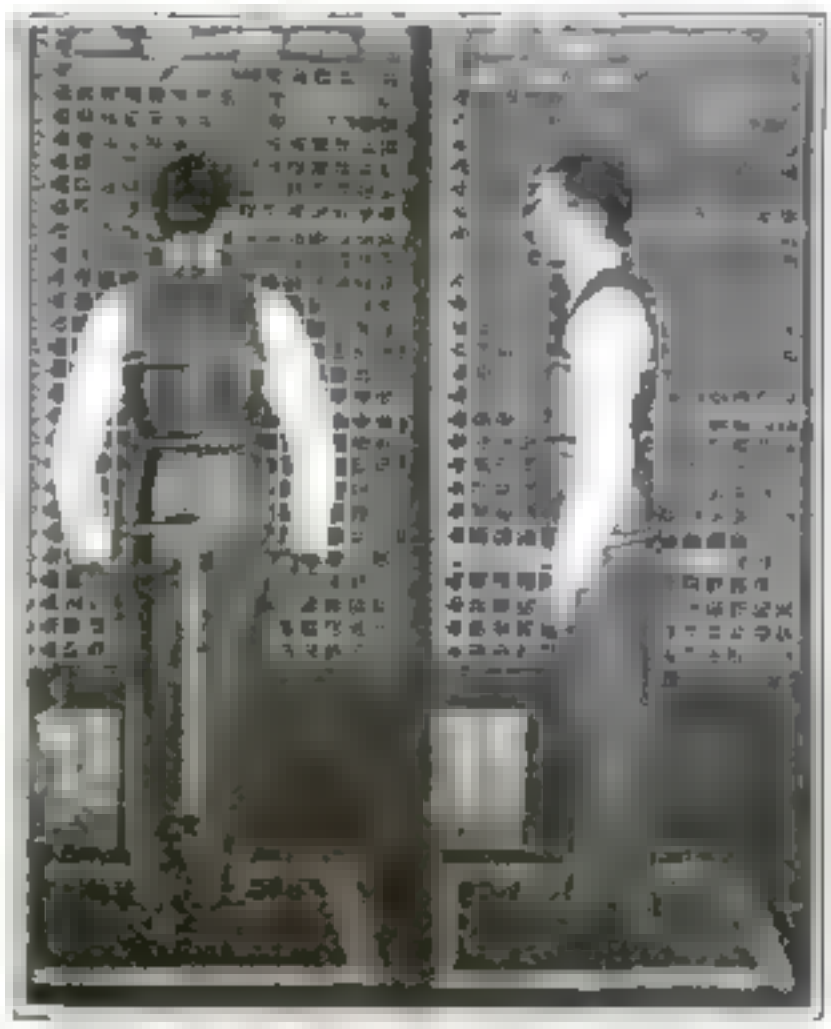
"THIRTY-TWO," mumbles the tailor as he wraps a measuring-tape around you; then he tackles another spot, and another. No wonder men hate to have their suits made to order.

Now, however, with the aid of a camera and a chart, your measurements can be taken at one check. First you turn your back to the camera and then you have your side view taken, from these two pictures the tailor makes your suit.

The chart is built like a big checkerboard ruled off with white lines two inches apart, running vertically and horizontally. The camera is always at a fixed distance from the chart, and you stand on a white cross in front of the chart. White tapes around the body aid the tailor in his calculations.

How does the tailor calculate the actual circumference of your body at various places? He takes the front and side dimensions, adds them together, divides the number by two, and multiplies the results by 3.1416—the number in mathematics that denotes the ratio of the circumference of a circle to its diameter

No longer need you be measured minutely by the tailor instead, you may have your picture taken against a chart and then let the tailor figure you out



The back view and the side view are photographed and from these the tailor calculates your measurements

To Tell One Typewriter from Another

By Alfred Gradenwitz

THE issue of many legal cases turns on the authorship of a given sample of typewriting. Now, though by no means a hopeless task, the identification of typewriting affords incomparably greater difficulty than that of handwriting. According to Professor W. Scheffer, a microscopist who acts as legal expert in such cases, the first step is to ascertain the general type of writing—Roman, Gothic, italics, imitation of handwriting, etc. Then comes a closer analysis, partly by means of the microscope.

It should be considered, in this connection, that a given sample is the product of a number of different factors. Apart from the form of type, the mechanical arrangement of the type levers and letters and differences in the arrangement of the various letters of a given machine should be taken into account. Then comes the personal factor—the variable strength and uniformity of touch and the speed of the typist—and, finally, the structure of the ribbon, which is liable to alter the form of individual letters.

In investigating the letter types of a machine, the expert can resort to one of two methods: He can inspect the types by means of a magnifying-glass, either in their natural position or after removing them.

The second method, generally preferred in fixed-type machines, consists of removing the ribbon and substituting a sheet of high-class carbon paper. This will bring out

How the letters of a typewriter appear under a powerful magnifying glass. The examiner can bring out very small details of construction valuable in identifying typewritten manuscripts. In determining typewriting the personal factor is important—the varying strength and uniformity of touch and the speed of the typist—and also the ribbon structure

How the small a looks on three different machines. Although they appear alike at first glance, the scientific examiner would be able to demonstrate their difference by actual measurement

Words made on two machines of the same manufacture. The type on one aligned perfectly, while that on the other did not. This is important in the identification of typed documents

The spacing between the letters depends upon the mechanical construction of the typewriter. By writing upon this carefully ruled surface the difference in type spacing may be determined

the most delicate details in the shape of the types.

The A in most machines with a horizontal A lever shows a decided tendency to strike double. When the A stands beside a letter with a vertically swinging lever, its relative position may be higher or lower, according as the typist is writing quickly or slowly or striking hard or soft, and the same may occur in connection with other letters. The relative position and alinement of letters, therefore, does not allow the kind of machine to be ascertained, though it may afford a useful clue as to the identity of the typist.

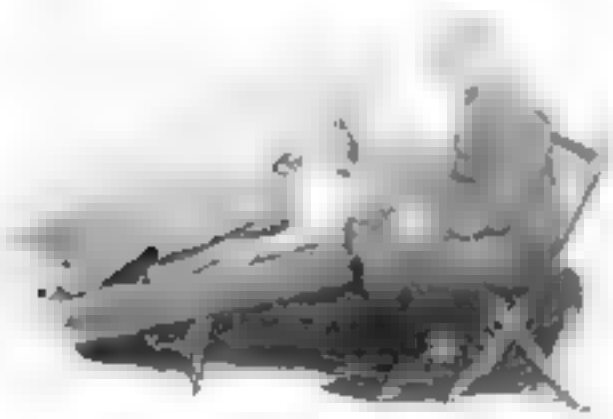
Professor Scheffer also uses a special gaging process. On the basis of the dimensions of the corresponding parts of the machine, as ascertained by the most careful measurements, in conjunction with measured samples of typewriting, he prepares a photographic grating into which the writing of a given machine fits exactly. If, now, the sample at issue, on being covered with the grating, is found to fit into it accurately, there is evidence of the sample having been written on a machine of the same make.

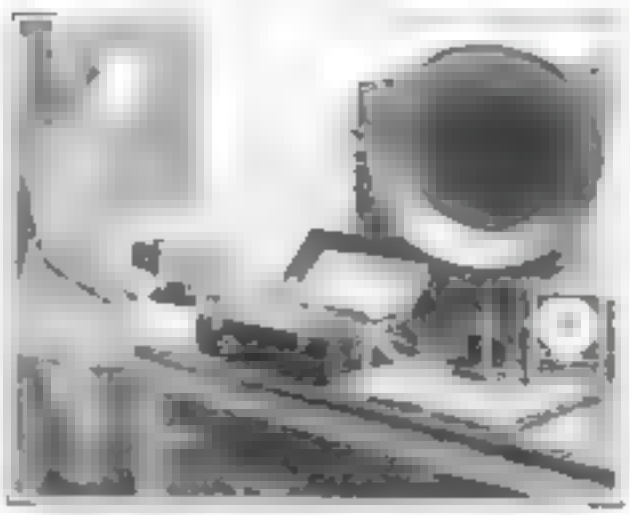
Listening to Heartbeats by Radio

PHYSICIANS in New York city may now listen to their patients' hearts beating in San Francisco. The heart produces a delicate sound that may be heard by a person placing his head on the patient's chest.

The vacuum tube that makes possible the long-distance listening just mentioned is a new stethoscope. It amplifies the sound of heartbeats electrically, and they may be made so loud as to be almost deafening. A special telephone transmitter is placed on the patient's chest. This is connected with several vacuum tubes that amplify the current so that it may be fed into a telephone circuit or a large wireless telephone-transmitting outfit. When medical men meet, the heartbeats of a patient may be made loud enough to be heard throughout a large auditorium.

Two hearts seldom beat alike (there is no sentiment about this), and medical men can often diagnose certain ailments by simply listening to the heart action.





The part of the apparatus shown above is used in magnifying the sounds of heartbeats. It can be connected with a distant patient and the heartbeats heard perfectly. A special telephone transmitter is laid on the patient's chest, as shown at the left

Making Money Out of the Bamboo Shoot

It rivals American sweet corn in flavor and grows at the rate of a foot a day

By Captain H. P. Sheldon

The small shoots have a delicious taste and are very healthful. Here you see a plateful of shoots that have had their husks removed. One of the shoots, however, is still in the husk

A GIANT grass four inches thick that grows a foot a day until it is fifty feet high—such is bamboo. Its sprouts rival our sweet corn in succulency and flavor, its towering stem will furnish timber to make furniture, fans, and fishrods, tent-poles, trellises, and toothpicks; its graceful outlines and green and golden beauty rival that of the white birch

Is it any wonder that the Bureau of Plant Industry of the United States Department of Agriculture encourages the cultivation of this fast-growing Oriental grass?

You first encounter bamboo as an edible in that Chinese dish known as chop suey. It is a morsel of firm, wholesome texture and delicate flavor, but from the tender sprout. Hitherto America has relied upon imported preserved bamboo sprouts, but now we receive the fresh home-grown article from our own plantations.

For the bamboo is already flourishing in several American groves, the oldest of which is near Savannah. Another profitable grove is located at Avery Island, Louisiana. The plants were introduced first by a Cuban rice-planter some thirty years ago, and later, in 1902, David Fairchild, a plant explorer for the United States Department of Agriculture, succeeded in introducing other sprouts. The bamboo finds our Southern climate and moist soil friendly, and there now remains no question as to the adaptability of the giant grass in the Southern Atlantic, Gulf, and Pacific states.

One plant will form a grove, for it grows and spreads much in the manner of its smaller cousin, asparagus. It needs no cultivation whatever, once it is established. An acre of bamboo will produce one thousand sprouts each year for forty or fifty years.

A few days ago, Secretary of Agriculture Meredith received a package of edible shoots from a Louisiana plantation that Mr. Fairchild started. Mr. Fairchild, sponsor of the new industry, and perhaps better informed on bamboo than any one else in America, says this about bamboo culture: "The high food value of the bamboo shoots—about equal to that of the onion—their earliness as a spring vegetable, the fact that permanent plantations can be established and that the timber from the uncut shoots has an increasing market value, makes me confident of its successful introduction into American horticulture."

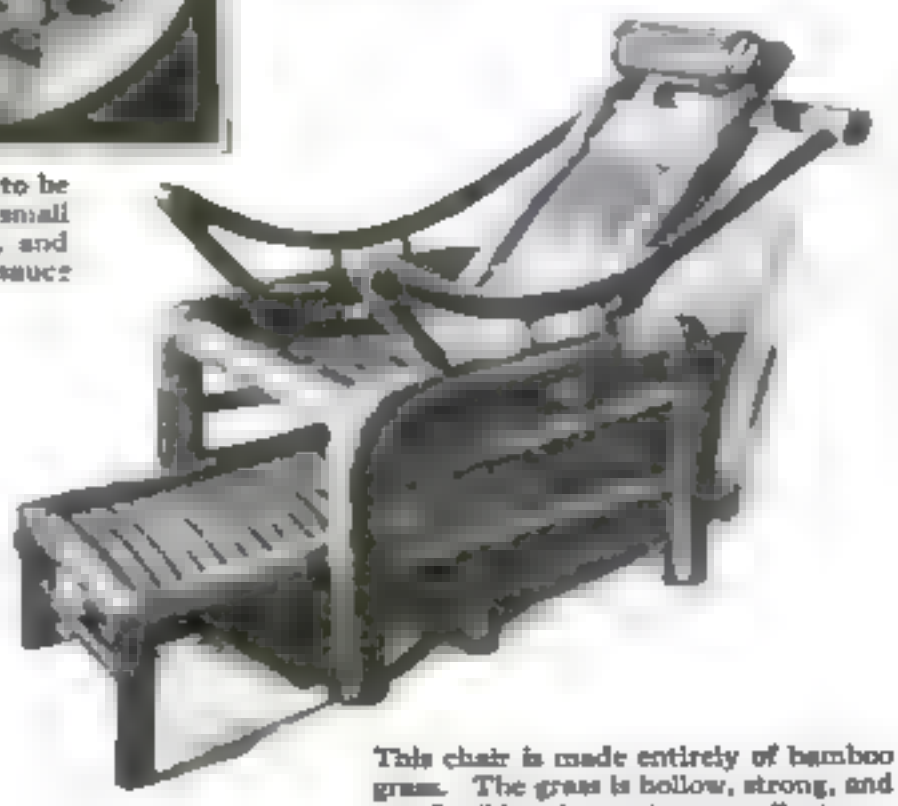
In preparing the shoots for the table the brown outer husk is stripped off, the tender sprout sliced lengthwise, and boiled for an hour in salted water. It is served with drawn butter

A description of its industrial value would run into as many paragraphs as a treatise on the value of our native pine—but there is this difference: generations of man must come and go while a pine sapling reaches maturity, but the bamboo achieves the same result in a space of months! Its hollow construction and impervious surface make it useful for drainage and water pipes and for any framework requiring extreme strength combined with lightness and resiliency. The long fibers are extremely tough and pliable and are well suited for basket-weaving and barrel-hoop making, etc.

The plant-loving people of the Far East have long recognized the peculiar, graceful beauty of the bamboo as a feature in their landscape grouping; its slender height, delicate coloring, and feathery foliage are unusual even in a tropical landscape abounding in variegated plant life, and as a place in which children can play, no other spot can rival the deep green shade of a bamboo grove.

Six years ago Rufus Fant planted a bamboo shoot on his property at Anderson, South Carolina. Here you see him standing in the grove that grew from that original plant

Here are the shoots, ready to be cooked. They are cut into small pieces, boiled for an hour, and then served with a butter sauce



This chair is made entirely of bamboo grass. The grass is hollow, strong, and yet flexible hence it is excellent material from which to make furniture

Photography Becomes a Detective

Two glass plates superposed show what paper has been taken from your desk

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What Stones Have Been Shifted in this Wall?

Here (on the left and on the right) are two photographs of the same stone wall taken at different times.

A few stones have been misplaced and a soft felt hat placed on a stone was removed before the second picture was made. Study the photographs and see if you can detect the difference. The hat will help you.

Look at the black photograph just below and you can detect the changes at once

SUPPOSE that a complicated machine is to be drawn—a new type of locomotive. Suppose that the designing engineer modifies the construction from time to time. He changes the position of a connecting-rod here at one time, or the position of a lever at another time, dispenses with a gear, inserts a spring where there was none before. Perhaps it becomes necessary to make a new set of drawings.

The changes indicated may be so slight that only by the most minute comparative study is it possible to determine what changes have been made. So, too, during the construction of a huge office building or a bridge. What progress has been made from day to day? Mere inspection will not supply the answer.

Mr. M. H. Stillman, of the United States Bureau of Standards, has devised a simple photographic method that makes it easy to spot these slight changes in drawings or structures at once.

Take a stone wall, for example, a rather loose structure of almost indiscriminately piled rocks following a general line. Suppose that stones are added or removed. Mr. Stillman makes a photograph of the wall on one day and then another photograph on some following day. From one of the negatives he makes a positive on glass. This positive is placed exactly over the other negative and a print is made. At once the changes are revealed by either dark or light patches against a uniform background

If no changes have been made, the light portion of one plate registers with a corresponding dark area on the other, and conversely. When changes have been made between exposures, the lack of correspondence between the dark and light regions of the positive and the superposed negative are at once apparent. It is readily appreciated that by this method hours of painstaking labor can be saved.

Apply this method to a desk laden with papers and books. You can tell at once whether any one has shifted them about or removed some of them.

The Telltale White Streaks and Spots

From one of the negatives of the two photographs appearing at the top of this page a glass positive was made. This positive was placed over the other negative so that all details registered. Where they do not register, white streaks and spots appear on the print here reproduced. These white streaks show what stones have been displaced or removed. A soft felt hat, for example, was removed after the first photograph was made. It appears as a white spot on this picture

It is often useful to follow the progress of a building in the course of construction by showing the amount of work done during any interval of time at the beginning and end of which photographs are taken. This application is shown in these three photographs

The first and second photographs were made at different times. The third photograph, made in accordance with the principles explained in the article, indicates by means of the white spots what changes have taken place between the interval when the first two photographs were made

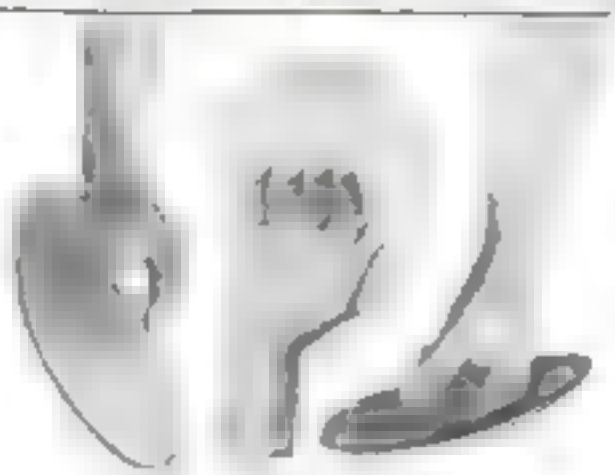
The Tractor as a Stump-Puller

NEW uses for the farm tractor are constantly coming to light. The picture above shows an Iowan farmer pulling up a small tree with his gasoline tractor. When the driving wheels are properly chained to give positive traction the machine makes short work of hauling the trees up by the roots.

During the war, when dynamite was unobtainable, the resourceful tractor owner decided to press his machine into this service, and now he would not think of ridding his land of stumps or trees in any other way. It is much cheaper and safer than dynamite.

It is a constant source of wonder to farmers how they managed to get along before the tractor was invented. Certainly they had to work harder.

Paddles Made of Metal for Swimmers



REMINISCENT of Roman conquerors are these shield-shaped paddles. But they are not intended for the gentle art of self-defense; they are meant to increase a swimmer's speed, in emulation of the webbed foot of the duck.

It is very simple to understand that a flat surface, not too heavy, will offer a more effective resistance to water than the hand and that a person would be propelled through the water with much greater speed by using these paddles.

They are made of tin or aluminum, the rolled edge giving the needed strength. On the under side are two loops, also of metal, through which the first and third fingers are thrust. If you would like to increase the power of your swimming-stroke, here's your chance.

Trailers for Limousines

HAVE you noticed that the trailer has left the farm and gone to the city? It appears nowadays that no limousine belonging to the very best families is complete unless it resembles an ancient chariot. What is it used for? Carrying trunks, suitcases and other pieces of luggage. People with limousines are always going somewhere.

The trailer has solid wheels with hard rubber tires that are well able to stand the strain caused by heavy trunks. Each wheel has a corresponding mudguard that keeps the trailer clean.

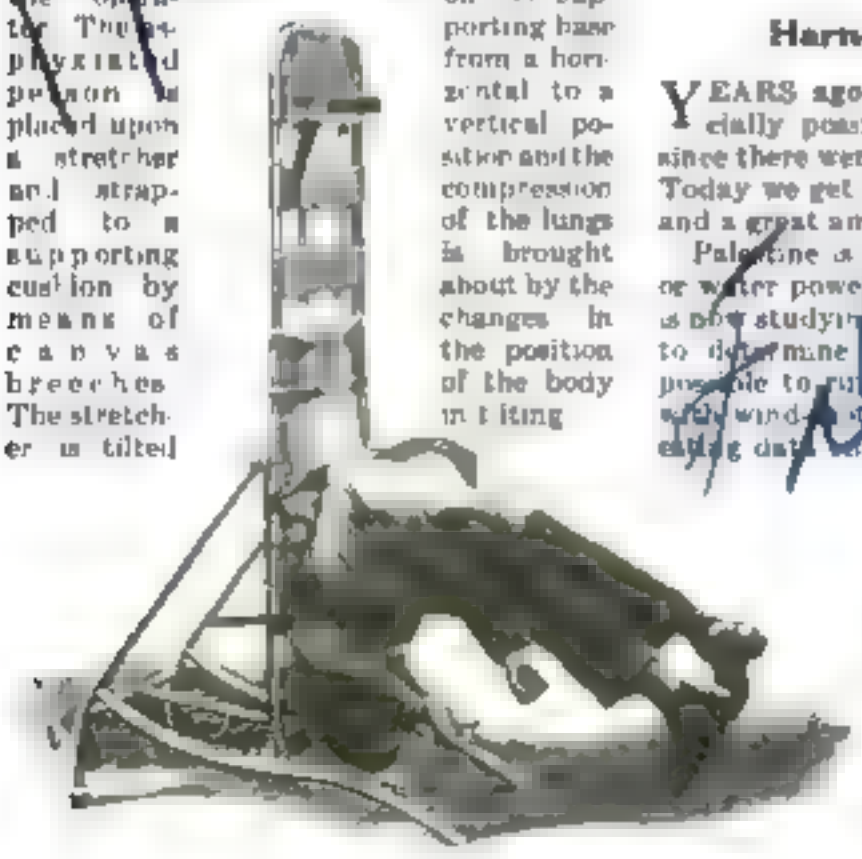
Usually this very useful accessory to automobile equipment is painted to match the limousine with which it is used. Note the strong coupling-bar that connects the trailer with the limousine.

Resuscitating the Drowned by Machine

TO resuscitate persons who have been drowned or who have been otherwise asphyxiated, the chest is rhythmically compressed.

Sometimes the victim of asphyxiation dies because the would-be life-saver is exhausted and is forced to give up his efforts.

A German physician has now invented a machine that makes it possible to continue attempts to restore breathing for an indefinite period without placing a strain on the operator. The asphyxiated person is placed upon a stretcher and strapped to a supporting cushion by means of canvas breeches. The stretcher is tilted on its supporting base from a horizontal to a vertical position and the compression of the lungs is brought about by the changes in the position of the body in tilting.



Harnessing the Wind

YEARS ago, wind power was commercially possible. It simply had to be, since there were few other sources of power. Today we get most of our power from coal and a great amount from water.

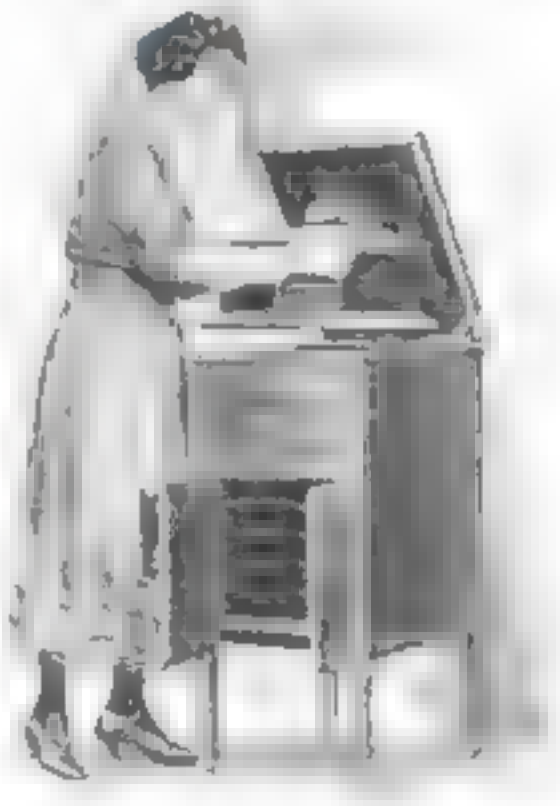
Palestine is not favored with either coal or water power, but Dr. I. M. Mayersohn is now studying the problem of wind power to determine whether it will be possible to run the industries of Palestine with wind power. He has collected interesting data on wind motors in Europe.

Examination of four hundred and seventy-seven installations was made. Eighty-seven per cent of these had worked satisfactorily for periods up to eighteen hundred years. Wind-power installations are now made in Denmark for the generation of electric power in small communities.

Buy a Cabinet for Your Small Phonograph

WHEN you buy a phonograph the price is governed as much by the case as by the mechanism. As a result many people buy cheap cabinets for phonographs at first, and then wish later that they had not been so economical. Now they are able to buy pretty cabinets in which they can drop their small machines. The woman in the picture is shown placing her machine in one of these cabinets.

One advantage of this idea is that the phonograph can easily be moved.

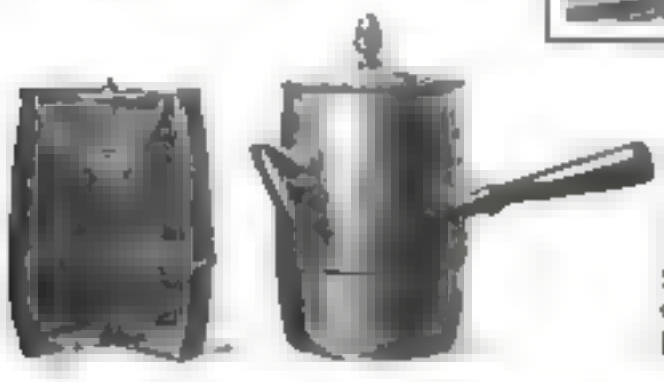


It Stops Boiling when the Coffee Is Made

"IS the coffee done?" That's a hard question to answer. Now, however, there is a coffee-pot that stops functioning when the coffee is done.

The pot is divided into two sections, separated by a metal partition. Through this center runs a tube, and the top compartment resembling a percolator.

The water is placed in the lower compartment, and as it is heated it rises in the tube, flows through the ground coffee, and drops into the upper compartment. This process continues until there is no more water in the lower half, the coffee is done. Of course you must be on hand to remove the pot from the stove.



A Bird's Nest Built in a Pair of Shears

THE tiny Bewick's wren who built the nest below chooses to dwell near farmhouses in many parts of America.

Sometimes it will build its nest in an old straw hat hanging in an out-of-the-way place, a rusty bucket or an old shoe, and one nest was seen in a tin can that lay in a barrel of trash in a farmyard.

The nest here shown was made of hay, weed stalks, and feathers. It was placed between the blades of the shears that rested on a rafter.

Aside from the music with which these diminutive birds please all listeners, they rid gardens of some of the worst pests to agriculture, and boys should be taught not to destroy them.

Butting the Coal-Cars

FOR butting coal-cars up an incline, a big railroad uses a mechanical billy-goat. The "goat" is attached to a long cable, which is wound upon the drum of a powerful boat. The boat draws the goat up the incline when it is pulling up a 60 000-pound load. It is sheltered by the shed over the trestle. When the car is emptied the billy-goat exerts the car down the incline. When the brakes are released it lets go and suddenly drops into a small valley between the tracks, the empty coal-car rolls on, takes a flying switch, and goes over to the empty track.

Each Motorist Ferries Himself

THERE is a ferry-boat on the Thames, England, that has no Charon to guide it from one bank to the other. It was built to enable motorists to get across without taking the usual roundabout trip, and it is operated by the motorist himself.

The boat measures fourteen by forty feet, allowing plenty of room for even very large cars.

It has in its side a slot through which a chain passes. This chain runs from bank to bank and fits over the teeth of three cog-wheels. A large fly wheel operated by the motorist himself, as shown in the picture below, sets these cog-wheels in motion, and as a result propels the boat across the river.

Suppose the boat is at the other side when a motorist wishes to use it. There is a winding wheel at each bank that enables him to draw the boat toward him.

The Lincoln Highway's Surfaces

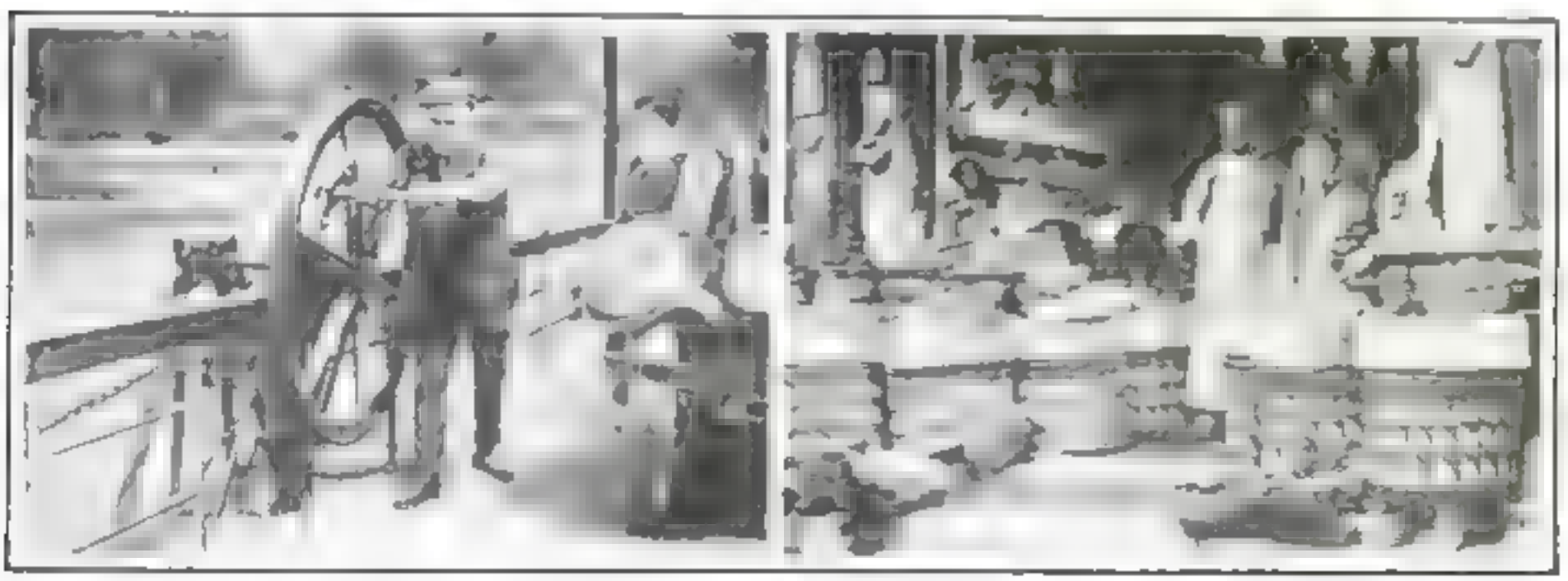
"A CONTINUOUS highway from the Atlantic to the Pacific, open to lawful traffic of every description"—this was the plan of the originators of the Lincoln Highway. In pursuance of this plan in seven years' time $11 284 520 was spent in improving the road.

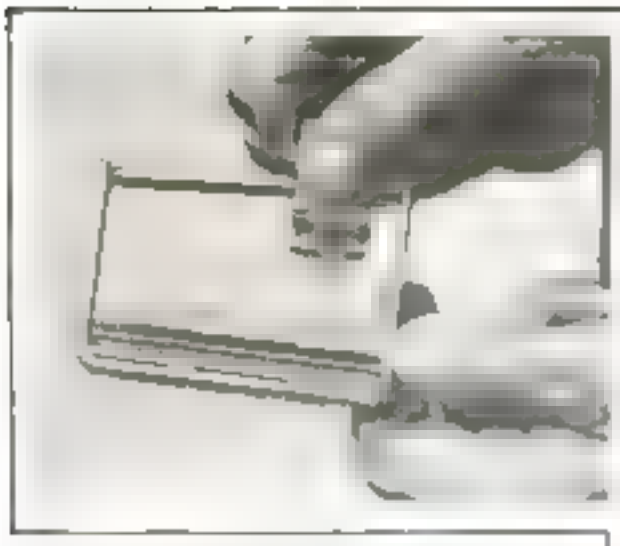
It is interesting to note that the builders have used the most suitable material for the various sections of the country to be served, and that there are no fewer than twelve types of surfacing employed, beginning with 422.34 miles of concrete, and ending with 3.3 miles of sand.

American Fruit in China

ONE quarter of all the people in the world live in China. And there is not enough fruit in the country to supply them all. Hence Japan and the United States are both selling fruit there.

In the picture below you see a fruit-stand in Peking. The fruit has been arranged to good effect by the three smiling vendors. Apples, oranges, lemons, and grapes that were grown in the United States are sold there. Until recently the people of the upper classes were the only ones who were able to buy fruit. But the wage-earning ability of the Chinese laborers has been slowly increasing of late years, and American growers anticipated an ever-increasing market in China. But, alas, for the poor Chinese, the failure of their own crops will prevent them buying anything more than the merest necessities for some time to come.





Back and Forth as It Sharpens the Blade

USUALLY it is when a man is in the greatest hurry to shave that the razor-blade is found to be dull. That is the time the little sharpener shown above will come in handy.

No leather or rubber wheels are used. The blade is clamped in a little vise and the sharpening substance is moved back and forth over the edges.

The sharpening element slides on a small rod mounted over the razor-blade.

A few strokes of the sharpener will put a dull blade in condition to shave a king. And a man no longer has to remember to take those dull blades to be sharpened; he is now independent of outside help.

One Engine for Cultivating and for Churning

PICTURED above is a garden cultivator that not only cultivates the garden crops, but that also churns, digs potatoes, serves as a cream-separator, mows lawns, pumps water, and runs a grinding mill.

It weighs two hundred and eighty-five pounds when fully equipped. Its engine develops four horsepower and runs from four to eight hours on one gallon of gasoline.

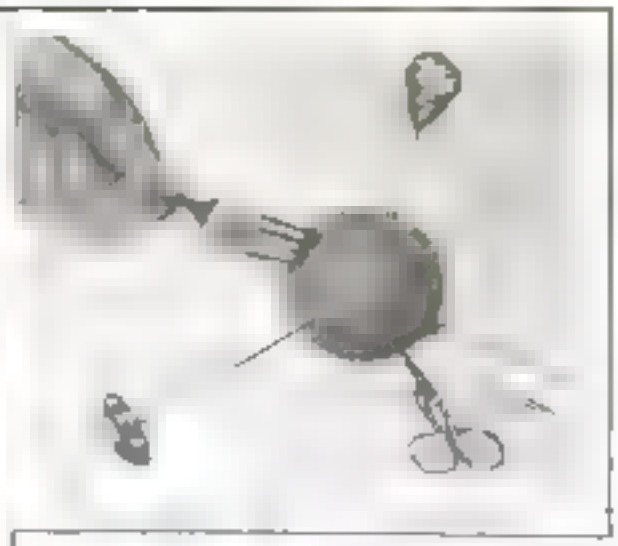
As the cultivator is guided down the garden there should be rows twelve inches or more apart. It can work between rows two feet apart and can be converted into a lawn mower.

Beware of Argentine Ants

ARGENTINE ants are such pests that when they decide to invade a house, two minutes after the table is set they look like the one below. [illegible] run!

In spite of their South American name, these ants are found in the United States. They were introduced years ago in coffee shipments arriving at Southern ports from Brazil.

If tape is soaked in bichloride of mercury tablets and then wound around the legs of chairs and tables, the ants will go elsewhere.



You Can Stick Pins in This Self-Healing Rubber Ball

HERE is a ball that is bullet-proof, pin-proof, and dog-proof. It is made of very live rubber with a light coating or skin like that on any other rubber ball, while the interior is made of spongy rubber.

A glance at the above picture will convey an idea of what the ball will stand.

If the dog gets the ball—as dogs often do—and chews on it for a while, no harm will be done. A ball inflated with air will not stand such abuse. A tiny pin-hole will allow the air to leak out, and the ball at once loses its resiliency, at the same time losing its value as a plaything.

This unpuncturable ball, or rather, a ball that heals itself, is very popular.

The Weeping Doll

"IF you have tears, prepare to shed them now," says Mary to her doll. Whereupon she squeezes a bulb that is concealed in the doll's back, and two large tears gush forth from the doll's eyes.

Such is the new crying doll recently invented by George J. Hoefler, of Stapleton, New York.

The doll's head is entirely hollow and watertight, except for two small holes in the eyes.

A large cork fits in the [illegible] through it runs a tube [illegible] inside the doll a [illegible] the end of the [illegible] has a few inches [illegible] It will come from the eyes when the bulb is squeezed.

An Adding-Machine for the Blind

AN attachment for an adding-machine has been invented which has the result that the blind can very easily learn the tricks of such a machine. The original design is the invention of a blind man. Castle and all of the necessary details have been worked out under his instruction. The invention is an attachment that can be added to a standard adding machine and is in the shape of an auxiliary set of keys. The keys are alternately heavy and flat and the operator works easily and quickly, his fingers flying over the keys as if he had perfect sight.

The usual glass over the numerals has been removed and the original figures fitted with the [illegible]

This Fountain-Pen Winds Up Like a Clock

THIS fountain-pen [illegible] eight-day clock. [illegible] two miles long [illegible] of ink becomes e[illegible]

It requires a l[illegible] make a line a m[illegible] ink is driven [illegible] new way t[illegible] little red [illegible] the end of a pin is folded inward and out several times until the reservoir of the pen is full.

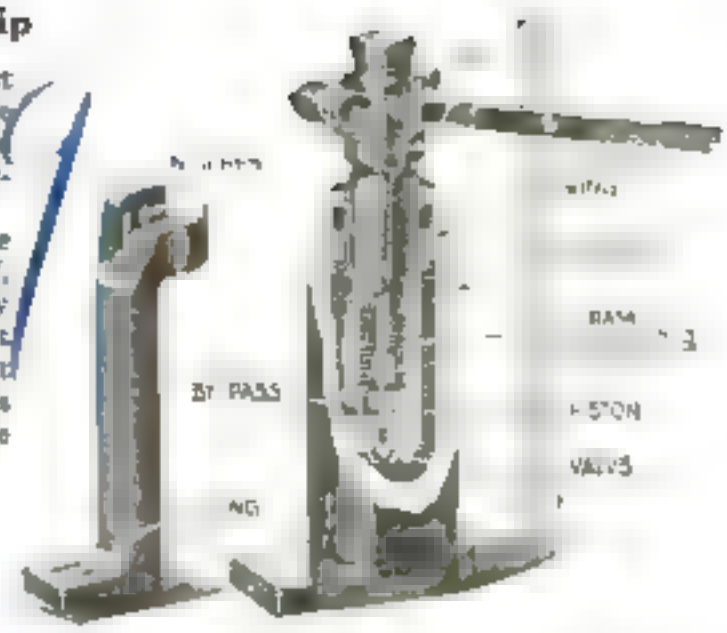
Fountain-pens in [illegible] caused a lot of sweat [illegible] "sworn," but this [illegible] taken its place nearly [illegible] behaved pens that w[illegible] want them to.

The Red Cross Above the Ship

HOSPITAL ships of to-day must wear a red cross not only on the side and stack but on top. This is to guard against attack by hostile aircraft.

In the picture below you see the large cross of the [illegible] an oil-burning hospital ship. By day its coat of brilliant red paint makes it plainly visible from above, and at night it is constantly illuminated, as are the red crosses on the side of the ship's hull and smokestack.

The ship is four hundred and eighty-five feet long and has a beam of sixty-one feet. There are eight decks in all, and they are connected by three elevators. [illegible]



They've Found a Use for Old Shells

MILLIONS of shells of all sizes were left over from the war. An Englishman has invented a small hydraulic jack that will lift ten tons. It is made from a 4.5 high explosive shell, and the ram from the eighteen-pound shrapnel shell. The detachable head of the 4.5 shell is divided into two pieces just a little forward of the shoulders that normally screw on to the body. The portion that screws into the main body of the shell is bored out to a suitable diameter and replaced to form a gland and guide for the ram.

Clasp the Grafted Bud

WHEN a bud is grafted to a tree, the resulting [illegible] must be bandaged until it heals. But this bandaging process is difficult and slow. Vincent [illegible] of Clifton Springs, New York, has invented a "budding [illegible] operated with all the [illegible] of a clothespin.

It [illegible] like the familiar spring-clasp clothespin, the grooved section grasping the young tree instead of the clothesline. This section is hollowed out to accommodate the bud, and the ends of the spring are firmly joined.

To Save the Lives of the Children of France

SINCE the war the French government has issued almost hysterical appeals to the populace, offering prizes for large families. This has had some result but not nearly enough. Why? Because the question of infant mortality was not taken into consideration, and the apparent gains were [illegible] by the large [illegible] from 15 to 20 per cent in the first year.

It is the judgment of a high medical authority that by cutting down infant mortality France could add one hundred thousand to its population yearly. The more intelligent of the population is asking, therefore, what is the use of rearing large families if their lives are not safeguarded by the utmost efforts of the government.

In response to this question, the Ministry of Health is making distinct efforts to give mothers better care, and to surround new-born infants with every possible protection against disease and death. This, in our opinion, is the right track—salvage rather than mere production.

Twisting the Wire's Tail

EVERYBODY is familiar with those flat pieces of cardboard or wood that can be transformed so quickly into boxes. Some of the boxes are bound with wire.

The [illegible] must be fastened securely together at the ends. While a pair of [illegible] would serve, the resulting twist is easily undone. Knowing this, S. P. Hauwens, of Rockaway, New Jersey, has invented a wire-twister resembling a brace-bit in form, but in place of the bit is the twister, with jaws to engage the wire, and cut it, after which the twist is pushed down flat.

Use a Headlight at the Piano

HERE is a headlight that is literally a head light. It is a light that you wear on your head. The wires and battery are concealed in a headband worn around the forehead and the light itself stands out in front.

This lamp was probably invented after the idea of the miner's lamps, that has also been adopted by physicians, surgeons, and dentists, its chief value to them being that both hands are free.

Thus you are provided with a flash-lamp that does not have to be held in the hands.

The picture above shows a girl playing the piano by the light of her lamp; she is well able to see the keys and music, although the rest of the room is dark.

Carry Your Bath-House with You

LIVING in a country of five hundred lakes, Virginia W. Collier thought, "Why can't I invent a portable dressing cabinet?"

Here was a real automobile need. Her first thought in the way of folding and of carrying the cabinet conveniently was suggested by a box kite. From this idea she developed a similar structure that would stand on end, simply planted on its spiked uprights in the ground and with an X at the top to give it support and maintain its form. Then came the task of making the uprights adjusted so that the whole structure would fold into small or large dimensions.

This resulted as in the cabinet shown, the whole folded and carried in a case the length of half the uprights.

She Boils Potatoes in Her Hat

SHOULD your hat be made of non-inflammable material, you can use it to cook your lunch in, as in the scene in the picture above.

She turns her hat upside down, fills it with water, and places it over a small alcohol stove. When the water reaches the boiling point she drops in two potatoes. Later she added some eggs. When eggs and potatoes were cooked, she emptied the water out of her hat, wiped it dry, and put it back on her head. Her lunch then was ready.

Of course, the hat is made of fireproofed material. Would it not have been easier though, for her to have carried a small pot with her?

An Electric Light for the Use of Firemen

WITH his old oil lantern, the fireman always took a great chance when he entered a gas-filled room. An explosion might occur.

The fireman's little electric flashlight shown below is perfectly safe in every way. The switch is conveniently located near the handle. The beam of light may be spread or concentrated.

When working in dense smoke, the beam may be concentrated to give it the proper penetrating power.

It is safe to say that these electric lanterns will before very long entirely displace the old oil lanterns that are seen to-day even on the most up-to-date fire-fighting apparatus. The life of a fireman is perilous enough and his equipment should include only the best.

Where Your Time Goes

DOES man accomplish much in his three score years and ten? Some interesting calculations have been made to find out what a man does with his time.

Basing these calculations on sixty years (counting out the first ten years of life as the period in which the subject receives more or less help in these duties), somebody with a flair for figures has made the chart below.

The average man, according to this chart, spends 8 months in dressing, eating, 5 years, 5 months working, 16 years, 8 months, sleeps 21 years, 8 months, he spends 7 months in church. The chart even goes into the details of tooth-washing and shaving, and arrives at the conclusion that there is left for pleasure 8 years and 11 months.

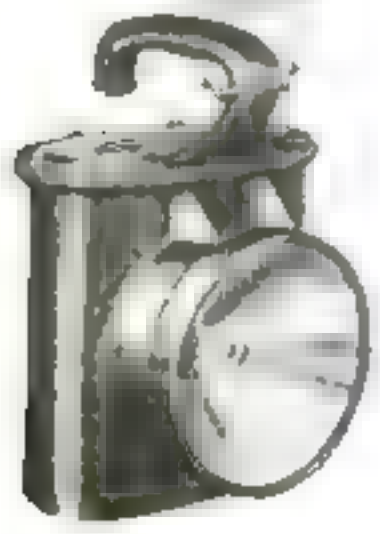
Buried in the Air on the Island of Vancouver

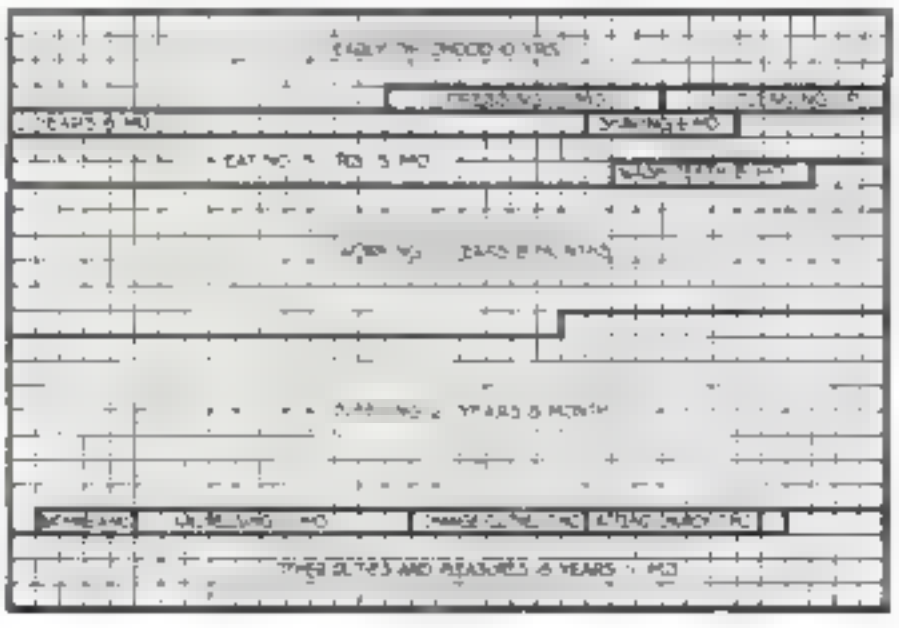
IN a small settlement on Vancouver Island, the natives inter their dead in a singular manner. "Bury" is hardly the word, since the corpse was not put below the ground but was elevated high above the ground on or in a coffin of cedar.

Beside the most carved figure at the top of the totem pole a corpse may also be found resting in the hollow at the back of the carved figure, and there is another corpse in the panel below.

According to the natives' belief, these poles were set up as protective fetishes in their lifetime, and, very consistently, they chose them as a safe resting-place after death.

Today most of the natives of this tribe follow the Christian religion.





A City Advertising Idea in the Country

"FOR SALE." When you hang up this sign in front of your house, the people who pass by are the only ones who will see it. And if your house is on a quiet street the chances for seeing it are not good.

A Los Angeles man found himself in this predicament. His house was on a hill about three blocks from the main road.

What did he do? He bethought himself of the advertising dollar sign, where the need for standing out from surrounding high buildings has induced advertisers to use the roofs. This man built a "for sale" sign out of boards and erected it on the roof of his house. The letters were painted white, and since they were four feet high they could be plainly seen from the main road.

Both a Weeder and a Cultivator

THIS device, a big help to the small farmer, is a weeder that cultivates as it weeds. It is adjustable in width, so that it may be used between rows of plants placed any reasonable distance apart.

The weeding teeth are attached to two arms which may be adjusted to any angle. As the teeth pull through the ground they turn the earth over, and also pull the weeds up as they go along.

The teeth of the weeder-cultivator are tilted in order to overcome the tendency to come to the surface as the weeder is pulled along.

Giving Trees a Start in the World Scientifically

REFOPULATING denuded forests is a job that falls to the United States Forest Survey, and it is done in the following manner. The seedlings are kept in a nursery during the first two years of their lives, and then are transplanted to the ground.

In the picture above you see the transplanting process. The young trees are placed in grooves in a board that is seventy-five inches long and that will accommodate fifty young trees. When all the grooves are filled, a second board is snapped into position over the first one, and the entire thing is put into a furrow in the ground. As the young trees grow, the boards gradually separate, and thenceforward the trees are left to shift for themselves and get on as best they can.

Hams Smoked the Modern Way

OLD-FASHIONED smoke-houses in which pork was either cured or burned up with the house are being replaced by a less dangerous and more sanitary smoking-stove.

This stove is made of metal, and is mounted on wheels.

It has a large oven in which the hams, bacons, and sausages of ten hogs can be cured at one time. Beneath the oven there is a drawer in which cobs and bark are burned.

The smoke rising from the fire passes through cooling tubes into the oven, and out the chimney.

After sixty hours of this smoking the pork is completely cured.

Acetol, a New Motor Fuel

PETROLEUM is not going to last forever. The supply is now getting low. Other substances may be used, but it has not been necessary to develop the other sources while there [illegible] gasoline. Farmers and inventors have been at work on this problem for a long time.

W. B. [illegible], an English experimenter, has developed a fuel which he calls acetol. Acetol is added to a mixture of alcohol and acetylene. It increases the absorbing power of alcohol for acetylene from three to four times. It may be added to alcohol in any proportion and in this way a fuel suited for almost any purpose may be prepared.

The inventor proposes to obtain the alcohol used from the sweet potato, which can be cultivated very easily.

Combined Cane and Fishpole

SIMPLY unscrew the handle of the cane shown below, take from the hollow interior two sections of rod, attach them to each other and then to the end of the cane, and you have a fishing-rod.

On the large handle there is still a smaller handle. By turning the small one you open two doors at the end of the large one and take your hook and worms from the hollow [illegible] within.

When your fishing is over, you simply replace your rod in the cane.

Joe Kosiuwski, the inventor of this fishing-pole, is a Pole himself, and he lives in Toledo, Ohio.

If you happen to be both a fisherman and a cane-carrier, then you will be able to appreciate this invention.

Twenty Minutes with Edison on the Typewriter

By **Raymond Francis Yates**

PERSISTENT rumors have been afloat that Thomas Edison invented the typewriter. As a matter of fact, credit for this should go to C. Latham Sholes, who started his experiments on a "writing-machine" in 1867. Nobody is more anxious to have this matter straightened out than Mr. Edison.

Sholes was not the first man to conceive of a typewriter, but he was the first man to "reduce it to practice," as the patent attorneys say. It was in a dingy little machine-shop in Milwaukee that Sholes and his associates developed the typewriter. It was no small job to build such a machine in those days. The alinement of the keys and the shaping of the parts was a stupendous job.

Six years of hard work brought the typewriter to a usable state. It was a big, clumsy thing, but it wrote, and wrote fairly well. Sholes made a brave attempt to manufacture and market the machine. He spent every cent he had in the world.

A man by the name of Densmore helped Sholes in his struggles and bought an interest in the patent. Finally, realizing that the venture should be placed in the hands of a big manufacturer, Sholes and Densmore made an agreement with the Remingtons, at Ilion, New York. From that moment the typewriter swung into commercial life.

Here is Mr. Edison posed beside the first practicable typewriting machine, which he says he did not invent

A few weeks ago I called on Mr. Edison, lugging into his [illegible] the original Sholes machine, which I had borrowed from the Remington Company. I wanted to ask the Old Man" some questions.

"Do you recognize the old machine?" I asked.

"Yes," he said. "It is the same type I worked on. I remember the hard time I had getting the keys in alinement. That was a nasty job. It is certainly marvelous the way the typewriter manufacturers get the keys in perfect alinement to-day."

"I understand Mr. Sholes called on you years ago. Did he come to you for advice?"

"No, Sholes did not come to me for advice. He simply called as a brother inventor. Sholes was a remarkable man. I believe it was back in 1873 that he called on me."

"Mr. Edison, do you know that some people credit you with the invention of the typewriter?" I asked.

"That is wrong," he replied with emphasis. "Sholes invented the typewriter, and he deserves all the credit he gets. Most inventors don't get the credit they deserve," he added. "I did practically nothing to improve the machine — although I built twelve of them for D. H. Craig, who had obtained the right to manufacture them from Sholes."

"Do you believe that we will ever be able to simply talk to typewriters and have them respond with automatic writing?" I asked Mr. Edison.

"No, I don't," he answered. "A sound-controlled typewriter would be operated by the sound waves produced by the human voice, and since no two men would set up the same disturbance, I believe it would be a very impractical arrangement."

A Belt that Is Also a Tourniquet

Two or three of these tourniquet belts will hold splints in place when an arm or a leg is broken. One of them may also be used as a sling to support the injured arm

[illegible] belt is pulled out. It passes over a roller which is part of a locking lever hence it is pulled in the [illegible] which

Above: With [illegible] is swung over to the locking position. Once locked it will hold until the lock is opened

Left: The tourniquet is so strong that it can be used successfully over a shoe, provided the man applying it has sufficient strength

Electricity is at last replacing steam in the driving of trawlers. Diesel engines drive electric generators, which in turn, supply the current to electric motors that propel the ship

You See Here the First Electric Trawler

THE first electrically propelled trawler has been built. It carries two large and powerful Diesel engines which are directly connected with the generators. The generators in turn supply current to an electric motor which drives the trawler. This motor is connected with the propeller-shaft, and it may be controlled from the pilot's cabin, where the necessary switches are located. From this point the boat can be started, stopped, and reversed. The driving motor is a 400-horsepower machine that pushes the clumsy boat through the water at fair speed.

The reader will probably wonder why the boat is not propelled by the Diesel engines direct instead of using them to turn electric generators which then supply the driving motor with power. Of course, engineers are forced to admit that some power is lost in this transformation of energy, but to offset this they are able to point out advantages that make it worth while.

Flexibility of operation is one of the advantages claimed. The trawler may be reversed from full speed ahead to full speed astern in a few seconds with the electric drive. This may be done from the pilot-house.

Smaller electric motors may also be used on the cranes and hoists for handling material. This speeds up the handling of material, and in the case of the trawler this is important

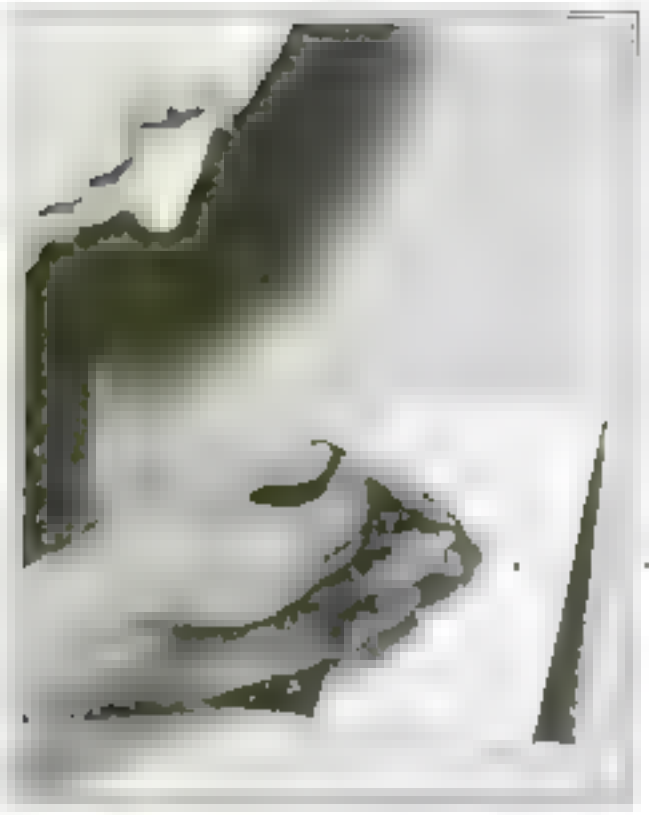
All of the big battleships that are now being built in this country are provided with steam-electric drive. In place of the Diesel engines, which are not built large enough for this purpose, and which are unsuitable for other reasons, steam turbines are used. These are connected with big generators, which in turn drive the large 8000-horsepower motors connected with the four propeller-shafts. The steam turbines produce 40,000 horsepower

Is It a Diamond or a Piece of Glass?

Every young man should learn these tests

1701

"Let me see some diamond rings," says the brave young man below. He chooses a beautiful stone but how can he be sure that it is a real diamond? Let him try some of the tests shown on this page

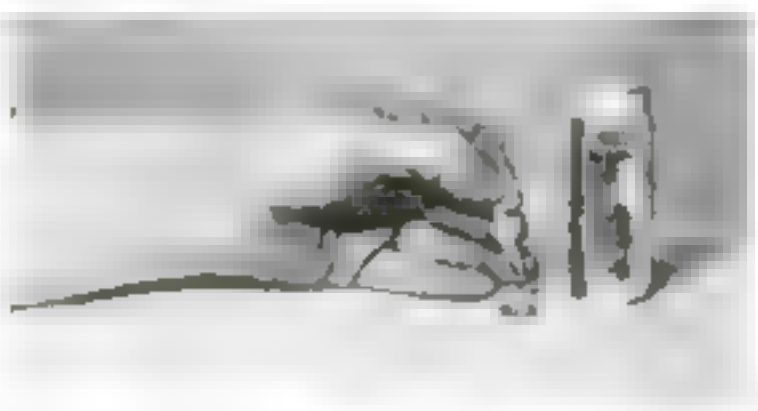


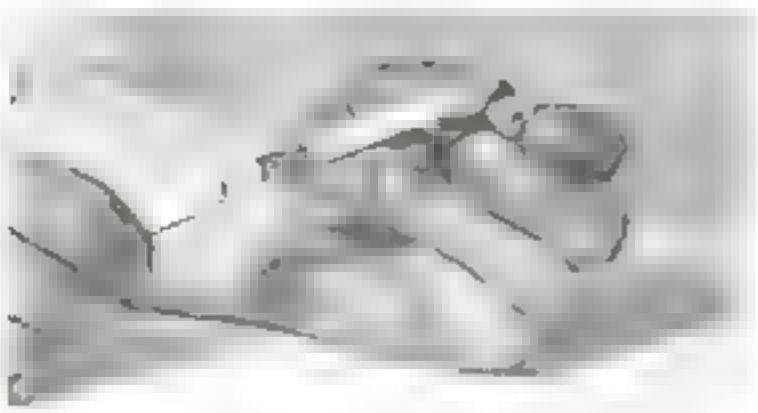
If the merchant objects to your giving the diamond rough treatment, try this. Look at a black dot on white paper through the diamond and a piece of glass. If the dot seems blurred or appears as several dots, the "diamond" is a fake

A real diamond is so hard that practically nothing will affect it. You can warm a diamond, cover it with borax, and drop it in cold water. It will come out unscarred, an imitation diamond, on the other hand, will break in pieces

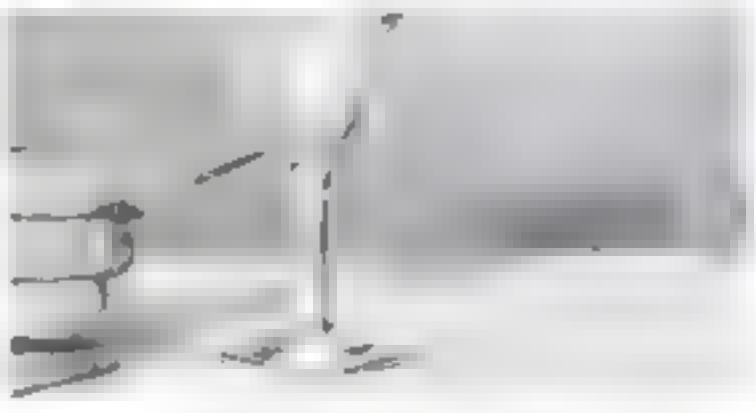
Here's another way to test a stone in order to see whether it is a real diamond or not. Drop some hydrofluoric acid on the stone; an imitation diamond will dissolve

A drop of water will retain its globular form when placed on a real diamond; you can move it gently with a pin. It will spread if the stone is counterfeit





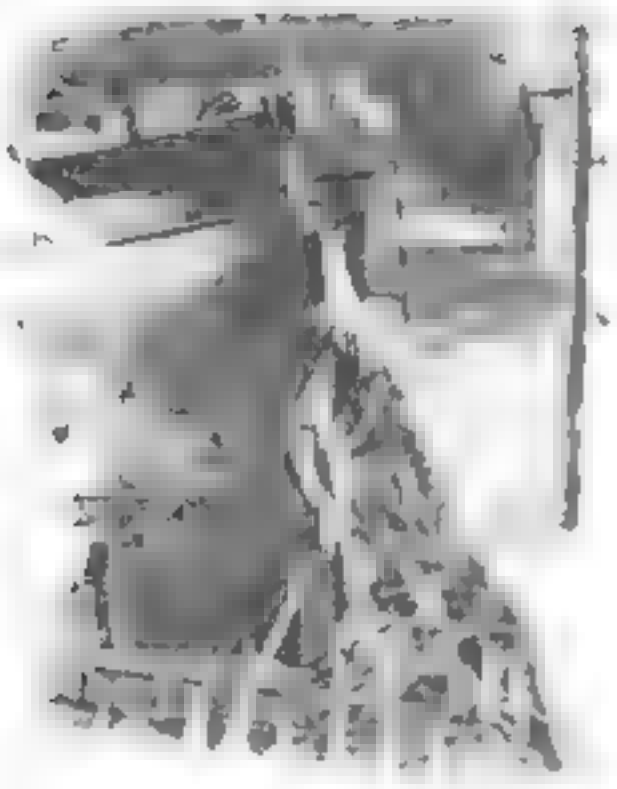
Scrape a nail-file along the edge of a diamond. What happens? Nothing, if the stone is genuine. An imitation stone, on the other hand, would soon show the scratches



Drop a diamond in water. You can see it plainly; that is because its index of refraction is so different from that of glass and of water. A glass stone would be barely visible

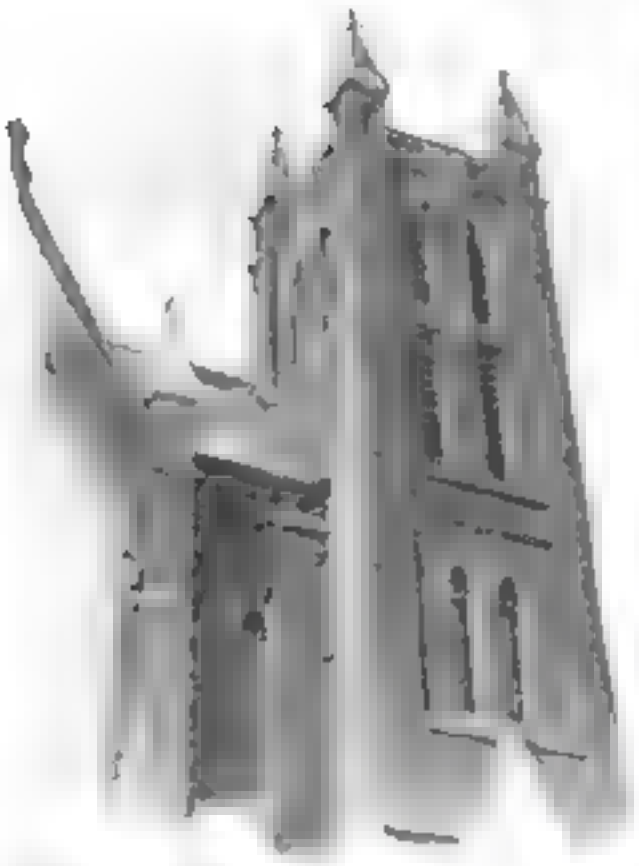
They Built Their Houses on Coal-Mines

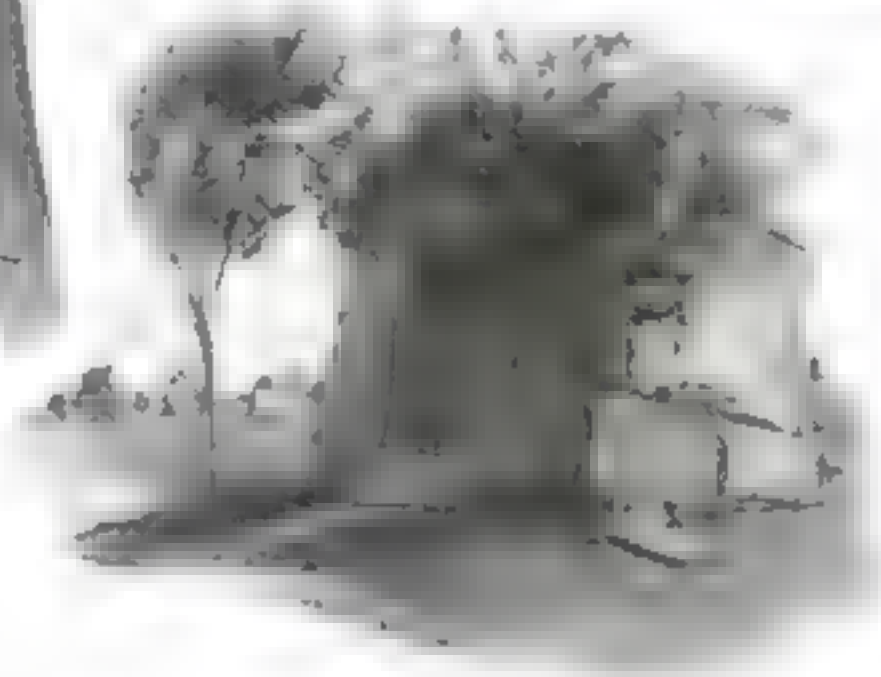
And this is what happened in Scranton



Here an entire street is slowly sinking beneath the surface. The earth is settling into the cavities that are located hundreds of feet below. This settling or readjusting process will require many years

These buildings have suffered badly. In certain parts of Scranton you may wake up in the morning and find the door and window-sashes sprung to such an extent that they cannot be moved up or down





Mother Earth respects neither homes, churches, nor cemeteries. Here is a vault gradually sinking to its doom. Within a few months it will be out of sight. It stands over one of the exhausted veins of a once prosperous coal-mine

Speeding Up the Hairdresser

HAIRDRESSING has not escaped the efficiency net, and recently a number of tests were given in a school for hairdressers, the object being to speed up that occupation

The tests proper were preceded by a written test to ascertain the pupil's mental elasticity aside from her profession

Then delicacy of touch was tested by means of what may be described as an "elastic scalp." This was done by asking the candidate to comb strands of hair suspended by the most sensitive elastic springs. Any pull at the scalp was registered by an electrical recording drum.

Another apparatus recorded the number and adequateness of those turning motions of the wrist, which are of paramount importance in waving, their rate being gaged in fractions of a second, while the maximum possible angle of rotation was read at the same time. Another attachment recorded the number and degree of uniformity of the minute vibratory motions in the use of curling-irons. The point aimed at in any case is an imitation as close as possible of the actual process, no special training being required

In order to test the pupil's ability to perform coordinate movements with both hands, she was asked to thread a number of wooden balls on a rod in a given order as quickly as possible, the time of performance being registered. The accurate simultaneous motion of the two hands, so important for handling the comb and curling-irons in waving hair, was tested by asking the pupil to perform with both her hands certain prescribed motions indicated by a chart, any deflection from the pattern being checked

This machine, used in testing the efficiency of prospective hairdressers, is called the "elastic scalp." Strands of hair are suspended by very sensitive elastic springs, and the motions of the person combing the hair are registered on an electric drum

An attachment for recording the minute motions followed by the hairdresser in using curling irons

Resistance to fatigue of the arm and hand muscles was ascertained by ergometer tests, the possibility of compensation by practice being examined at the same time. The retentive powers of the mind, most of all the taking in of visual impressions shown in rapid succession, is tested by special experiments. The discerning of delicate color shades is also ascertained by asking the pupil to sort strands of hair, while her personal taste and sense of form are gaged by having her pass on a number of patterns

The apparatus and processes above described have been found to yield invaluable services in connection with the training of persons wishing to follow the profession of hairdressing and passing the initial tests for aptitude.

Register Important Documents on Moving-Picture Film

"COUNTY courthouse burned to the ground; valuable records lost." With nearly three thousand county courthouses in the United States, it is not surprising that this announcement appears repeatedly. What about those valuable records - deeds, mortgages, marriage licenses, land titles, birth and death certificates? They disappear completely

Now, however, a system has been devised for keeping records of these records. Photographs of the records are taken on a moving-picture film, and the film is filed away. If desired, enlarged prints can be made from the film and duplicate record books kept. A thousand volumes, containing six hundred pages of records each, can be photographed on a film, which, when wound up, will measure but eighteen inches in diameter!

The photographing machine consists of a glass-topped table underneath which the deed to be photographed is held in place by springs. The camera is mounted on a frame at the back of the table. It is placed so that the lens points down and is directly over the table-top. The camera runs on tracks and can be moved up or down, according to the size of the picture wanted. Electric lights and reflectors are placed on both sides of the table shining on the glass-covered record

The camera is loaded with a reel of moving-picture film that is operated by a crank. It holds two hundred and fifty feet of continuous film, which is enough to photograph six thousand pages of records. The film of each

This is the machine that photographs important records on a roll of film

That small roll of moving picture film she holds in her hand contains negatives of all the pages in the seven large record books. Should the volumes be destroyed, duplicate pages could be made from the film

volume is placed in a metal box, labeled, and sealed with paraffin. The box is then placed in a vault.

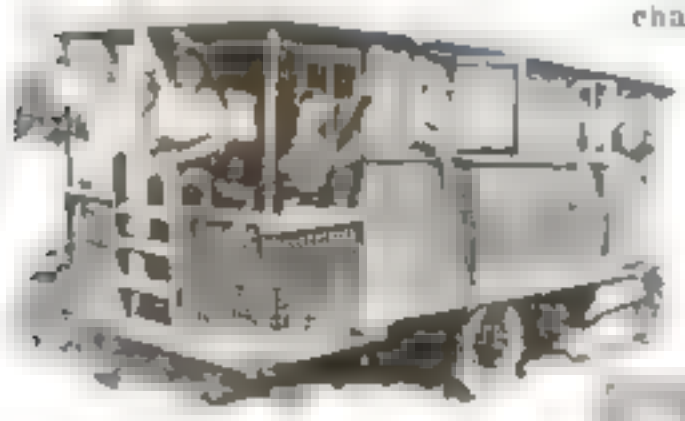
Should the original records be lost, burned, or stolen, prints could be made from these films that would show every mark, erasure, signature, and indentation that appeared in the originals.

Rival to the House-Boat

THE house-boat has a rival in the new house-car: both can be moved with ease from place to place. The house, as you see, is mounted on an automobile chassis. When you feel like moving to a new location you throw her into gear and step on the gas. No landlords, no land taxes—an ideal condition!

The house-car shown was built by a Californian. He and his family of five live in it all the year round, moving from place to place when they want a change of scenery. The bungalow is electrically lighted and heated and has a complete plumbing system.

The driver's seat can be made up into an upper and a lower sleeping-berth. The other members of the family, three in number, sleep in one large room of the bungalow. This room can be changed into a dining-room, a kitchen, or a living-room. There are plenty of cupboards and lockers in which to hide things when they are not being used.



A family that lives all the year in their house-car. It is electrically lighted and heated. When the family wishes to move, father cranks the engine

Photograph © Kadel & Herbert

This is the kitchen end of an automobile house. There is running water in the sink and oil in the stove. Bedroom, living-room, and dining-room are interchangeable

This welding machine will weld the bottoms to metal pots of any size diameter

Welding by Machine

A NEW development in electric welding is a welding-machine with electrodes that rotate. This machine will produce a continuous weld on metal kettles and pots of various sizes. Continuous welding met with little success before the introduction of this machine. The trouble is eliminated in this machine by separating the welding from the feeding motion.

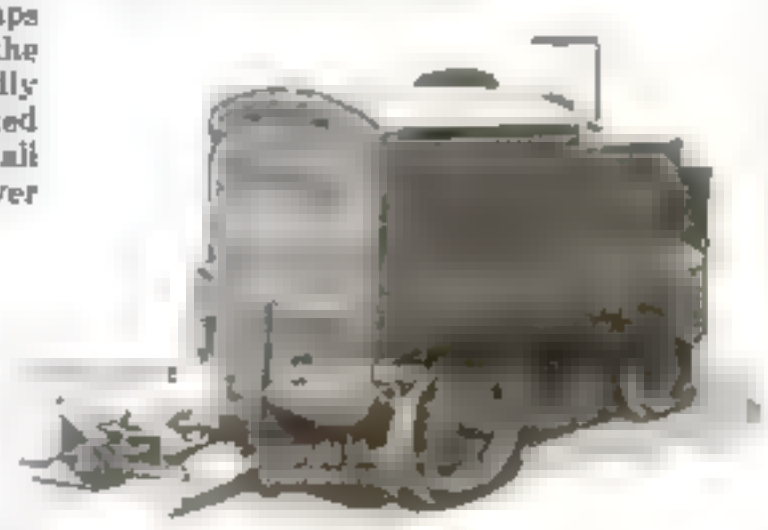
The motion of the revolving electrodes is intermittent. The weld made is allowed to cool before the weld is continued. In this way a series of welds is obtained that produce a continuous seam. With the machine illustrated, kettles of various sizes may be accommodated without any changes in the adjustment of the mechanism.

Couple Up the Trailer as You Go

HAVE you ever watched the little tractor that goes around on the freight-house floor, picking up the trailers loaded with boxes, packages, barrels, or crates? To couple on these cars it was necessary for a man to follow the loaded train, doing the coupling by hand. Now this work can be done by an automatic coupling device.

The driver backs his train up to the car that is to be coupled on, and the iron tooth of the coupler jaws snaps down over the coupling bar of the trailer. The work is done more rapidly than by hand. As the train of "picked up" cars moves to the spot where all the cars are to be left, the driver merely operates a lever, which uncouples the first car, leaving the string of cars where desired. A man with an iron bar uncouples every other but the last car.

Attached to the frame of the trailer is an iron bar so bent that it is readily seized by the coupler of the motor-car, or the opposite end of a trailer. The automatic coupler itself consists of an upper and lower jaw. A hooked "tooth" held by a strong spring clamps down in a slot in the upper jaw. A chain attached to this "tooth" connects with the lever at the driver's seat, and by it the clamp can be readily raised to release the coupling-bar of the first trailer.



The automatic coupling device is at the rear. It is attached to one end of each trailer car. At the left is shown how the bent clamp, or "tooth," operates

A "Wireless-Wire" System of Communication

IT has been found that a wireless or Hertzian wave will follow a conducting medium when it is given the opportunity of doing so. The Telefunken Co. of Germany has developed a commercial system of communication in which the high-tension transmission lines are used to guide the radio waves from one point to another.

It will be understood that the waves are not conducted by wires in the usual sense of the term. The wires merely guide the waves and cause them to follow certain courses. This is done while the lines are carrying very high voltages.

Seven Thousand Products from Coal

By I. Newton Kugelmass

WE have just come to realize that coal is valuable for no less than seven thousand substances useful to society. Only one tenth of the product is converted into these thousands of invaluable compounds, which means an annual waste to the United States of two billion dollars of coal by-products.

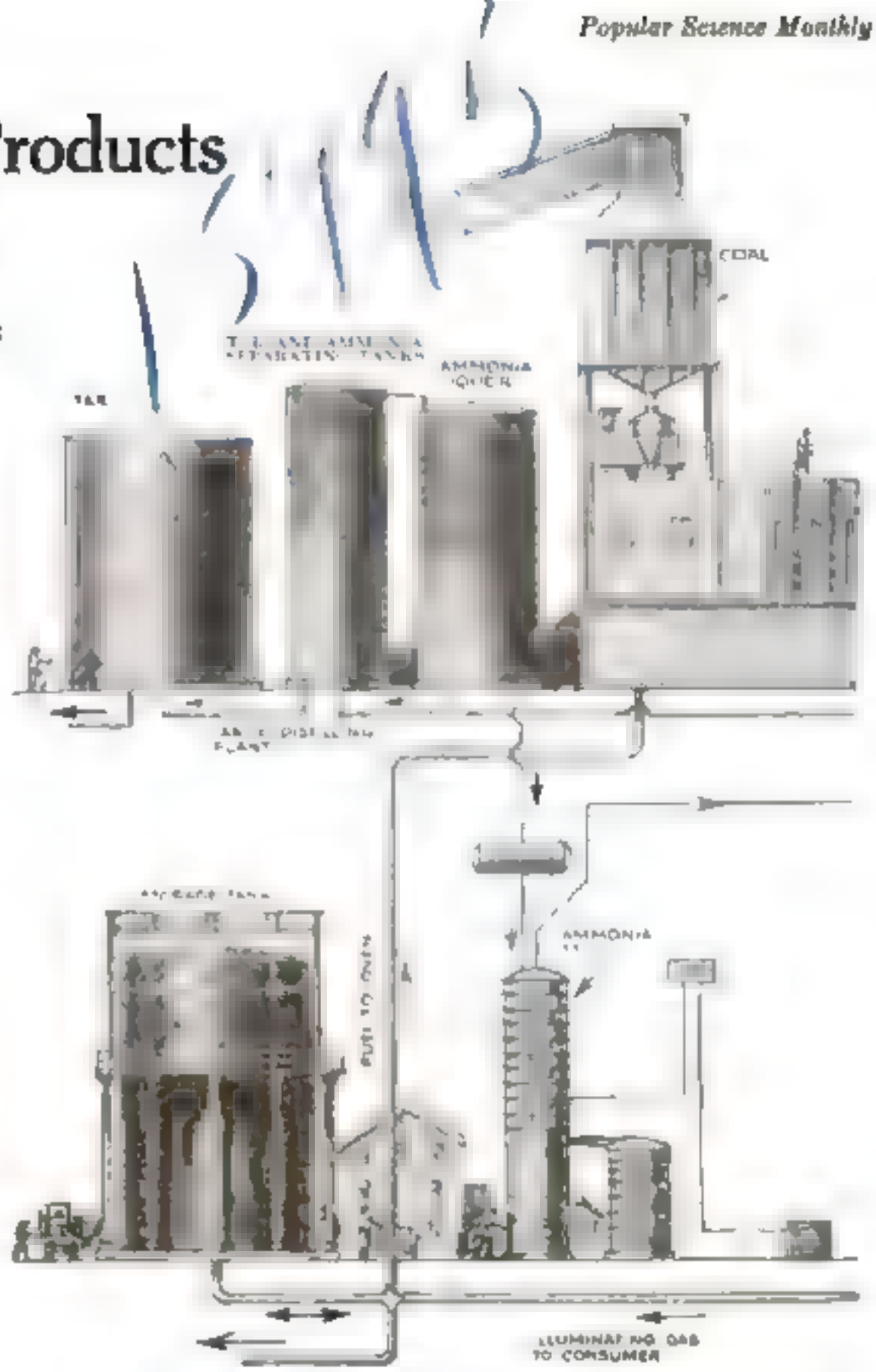
The Koppers oven is the latest for decomposing coal into its crude components, from which about seven thousand compounds may be obtained. Each oven has a capacity for ten tons of coal, which is carbonized for about twenty hours. Batteries of ovens are arranged in series, daily consuming thousands of tons of coal. The coal is fed into the ovens by a charging wagon, which runs on top of the setting.

How the Ovens Operate

The hot gases from the ovens pass up ascension pipes into a dry collecting main and through water-coolers at a temperature of about 33° C., thereby condensing the water and most of the tar. The remaining traces of tar are removed by passing the gas through an extractor. The gas is then reheated by exhaust steam to a temperature of about 70° C., and is passed into a saturator containing sulphuric acid, where all of the ammonia is absorbed.

In the coolers the ammonia liquor and tar separate by gravity. The ammoniacal liquor thus produced is distilled with steam and lime and the ammonia joining the main gas stream is also recovered in lead-lined saturators filled with sulphuric acid, where the salt is precipitated, removed, centrifugalized, dried, bagged, and shipped.

It may seem roundabout first to cool the gas and then reheat it, but this procedure has been found the most desirable from every standpoint. First, it is easier to extract the whole tar at a lower temperature than at a high one. If, in particular, the coal contains much chlorine, ammonium chloride would be produced, and if this were not removed from the gas, troubles would ensue owing to the decomposition of this substance in the saturator causing a production of HCl or hydrochloric-acid gas, destructive to the lead linings. Besides, the gas carries a large quantity of water vapor. On passing through the saturator the gas would give up some of this water and so dilute the bath as to make the formation of solid sulphate difficult. In the present procedure, the gas, instead of depositing water in the saturator, actually carries water from it, thereby aiding the formation of the sulphate of ammonia.

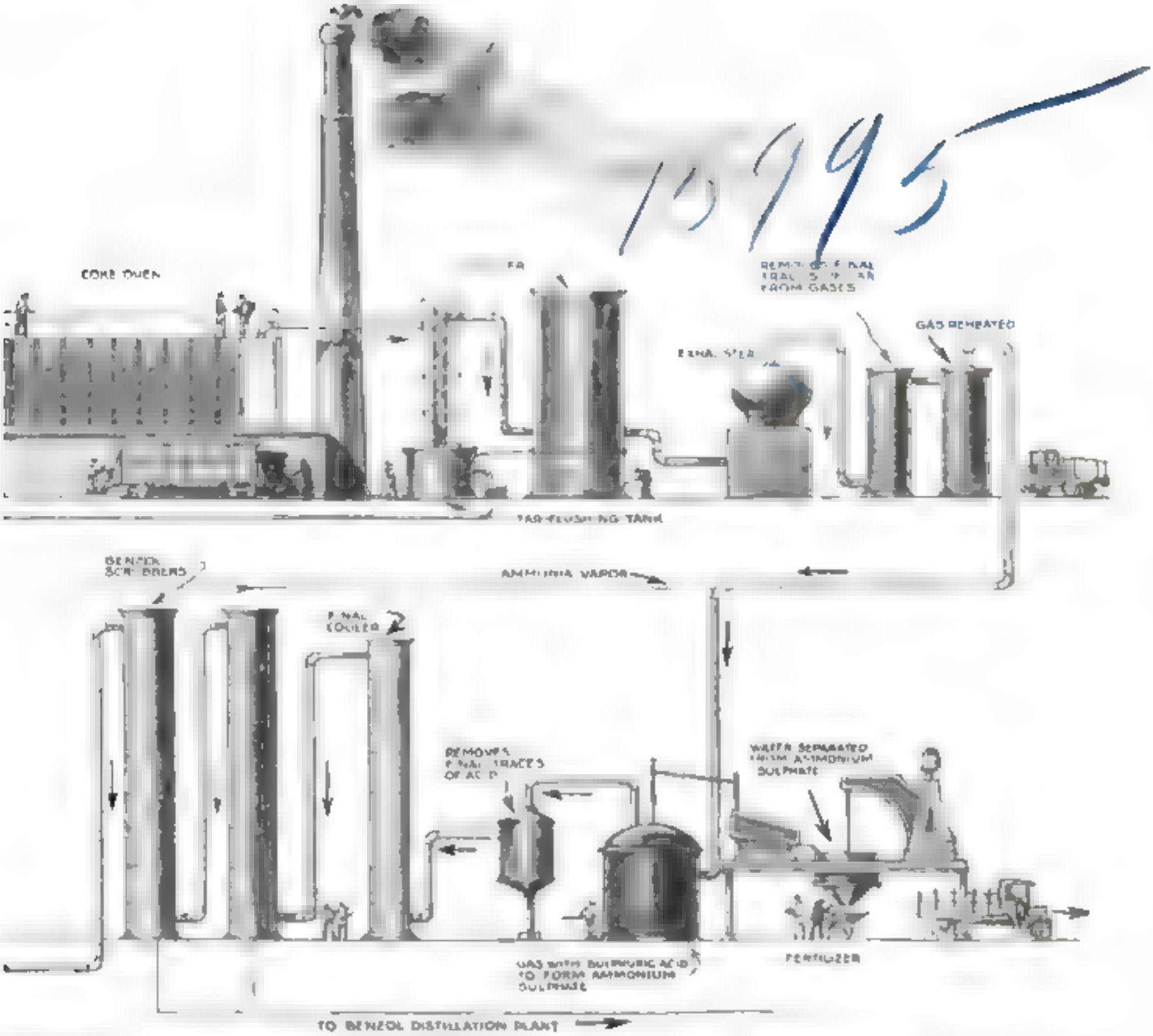


Coal is placed in an oven and heated without air. As a result, the volatile substances in the coal pass off into the system that separates one from another and puts them in marketable condition

Valuable products contained in a ton of coal. The combination of these products with other substances makes possible seven thousand compounds

Recovering the Benzol

To recover the benzol, the gas as it comes from the saturators is cooled to 24° C., and then washed with straw oil (petroleum oil of a specific gravity less than 0.875 at 15° C.). After washing, the benzolated oil, containing about 2.5 per cent benzol and its homologues, is run to a light oil still at 135° C. Steam drives off the light oil vapors



One valuable product recovered is illuminating gas, which is obtained in large quantities. The entire process can be followed by studying the diagram on these two pages from left to right

that pass to a condenser, and the wash oil is returned to be used again. From the condenser light oils pass to a fractionating boiler still, where 90 per cent of the benzol, toluol, etc., is reclaimed. For chemically pure compounds a further washing with acid and caustic soda is performed and that product again distilled.

Illuminating Gas Produced

The gas is tanked in the holder, a constant source of reserve. About 50 per cent is used to reheat the ovens and keep the boilers going; the rest is passed through boosters and sold as impure gas or purified and sold as pure gas.

The tar from the separating tank is forced by pumps to the tar-distilling plant. First, it goes through a dehydration in thin films under partial pressure, and then through a fractional distillation to produce the ten crude components. The stills are horizontal, cylindrical, set in brick with a protecting arch under the still bottom. The vapors are condensed in a long worm, arranged as a rectangular coil in an open tank. The condensing water is heated throughout. The condensate is collected in small tanks, where the oils are observed and measured. From these the fractions are discharged into receiving tanks and thence pumped to storage-houses. The several fractions are light oil or crude naphtha, middle oil or carbolic, heavy oil or creosote, anthracene, and tar or pitch residue.

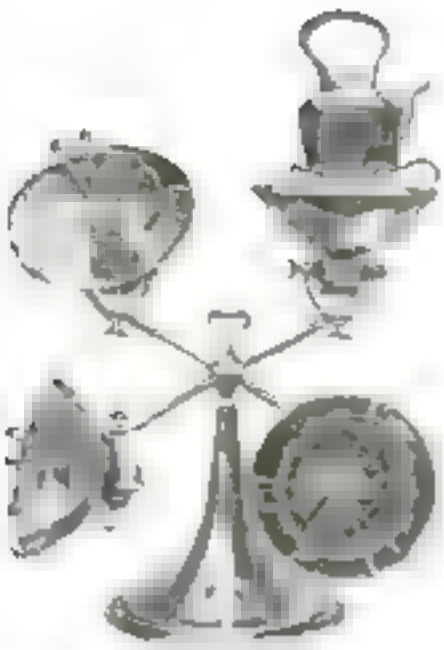
The light oil distillate (from 1 to 4 per cent of the tar) yields benzol for solvent, dyestuffs, nitrobenzines, sulpho-acids, azo-benzols, explosives, aniline, resorcin, phenol; pyridin for denaturing; solvent naphtha for xylols, heavy naphtha for para compounds and varnishes, carbolic acid for phenols and cresols, disinfectants, explosives, toluols for dyestuffs, toluidine, and explosives.

A Few of the By-Products

The middle oil distillate (from 5 to 15 per cent of the tar) yields carbolic acid for phenols and cresols, synthetic resins, plastics, salicylic acid, dyestuffs, organic compounds, picric acid, explosives, aspirin, flavorings; neutral oils for paint-thinners and stains; lampblack; naphthalin for organic acids, insecticides, naphthols, etc.

The heavy oil distillate (from 14 to 30 per cent of the tar) yields carbolic acid for phenols, cresols, disinfectants; wood preservatives; anthracene for lubrication, organic compounds, dyestuffs, and timber preservatives; lampblack, etc.

The residue beyond all the distilled fractions is refined tar and pitch.



An Electric Stove on a Pedestal

VARIETY can be found in stoves as well as in other things. There is an electric heater that is mounted on a pedestal in windmill fashion and is so light that it can be carried from place to place. Four electric burners project from the top of the pedestal, and they are all controlled separately. When you wish to use them, you swing them into horizontal position.

The picture above shows one of these stoves with one of its burners in action. If none of the burners is being used, they are turned vertically so that the stove takes up very little room. In the winter time the burners can be used for heating

Playing with Lightning

THIS is what a discharge of 1,660,000 volts looks like when it breaks down the resistance of an air-gap of 111 inches. There is a deafening roar, a great flash, and the smell of ozone as the terrific discharge rushes across the gap. The spark is only 111 inches long and represents a voltage of one and one half millions.

What voltage must a bolt of lightning represent which is several miles long? Of course, there is no way of measuring the voltage of lightning, but scientists believe that the pressure reaches many trillions of volts. The picture below was taken at Leland Stanford Junior University, where Professor Harris J. Ryan is conducting research work along this line.

A Book that Is as Tall as a Man

PROBABLY the largest book ever printed, when the matter of bulk alone is considered, is John James Audubon's The Birds of America published between the years 1827 and 1838. But when the size of the page is the only consideration, perhaps the largest book in the world is the one shown in the picture above.

As you will see at a glance, it is a book of maps. It was put together in the sixteenth century, and contains some forty pages, protected by a stiff cover.

Contrast this with the tiny inch-square volume, called "Brilliants," brought out some years ago by Theodore De Vinne. Its pages contained poems set up in "Brilliant" type, said to be the smallest in existence.

The huge book above is one of the treasures in the University of Rostock.

They Tried "Sail-Cars" in 1831

NOT very long after George Stephenson applied the steam engine to railroad transportation in England, [illegible] made a [illegible]

[illegible] was [illegible] long from [illegible] its center. The [illegible] tended to [illegible] the car on its course while the wind propelled it down the track.

Steam had not long been used as the motive power for ships, that it was not unnatural that inventors should seek to apply them to land transportation.

Make Your Own Rope

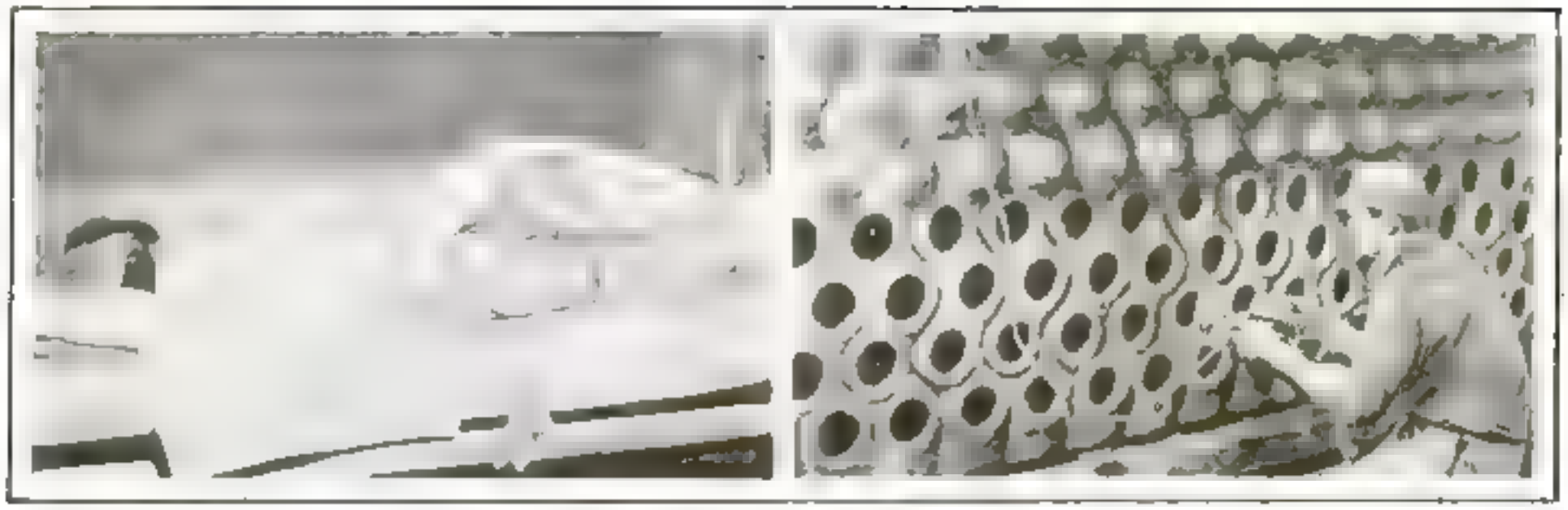
A NEW rope-making machine has recently been placed on the market by an Ohio company. With this machine you could weave your own rope out of binder twine.

Three strands can be woven into one, making very strong, smooth rope. It is almost impossible to tell where the rope is joined. Several short pieces of rope can be made into one solid piece.

The machine also makes rag rugs, shoe-cords, clothes-lines, automobile tow-lines, rope and cord woven together and a hundred and one other things that cannot be bought in stores.

Five pounds of binder twine will make one hundred feet of one-inch rope.

Courtesy Journal of Electricity



Much Needed Bedclothes Support for Invalids

FOR holding bedclothes away from a patient's injured limb, a support has been invented by Laura M Dobbins, of Orange, New Jersey. The device has wire arches connected by light longitudinal brace-wires.

The bars at the base are provided with rings at their four ends to which cords may be secured to hold the device in place. The ends of the cords are secured to the bedframe. In cases of patients suffering from burns or sores on the limbs or body, the device is of the greatest practical service.

The device is so constructed that it may be folded practically flat, thus permitting of its being carried or stored conveniently.

Grinding-Machine for Reseating Boiler-Tubes

INSTALLING new boiler-tubes has been made very much easier with the use of the little electric grinding-machine shown above. This device quickly removes scale and dirt from the caps and nuts of boiler-tubes and reduces the time necessary to produce a perfectly steam-tight joint. It leaves a smoothly polished smooth accurate surface that may be relied upon.

No great skill is necessary in handling the device. A workman of average intelligence may produce a surface that would be envied by a man capable of the very best hand-work attained by years of constant practice.

Two small wooden handles on each side of the motor enable the workman to hold and guide the little machine.

Send the Clothes to the City Laundry from the Country

A LITTLE house in the country is just the thing for the summer. Make the housework as easy as possible by having bare floors, and using paper napkins and doilies.

But clothes and bed-linen must be laundered, and of course the little house is not provided with stationary tubs, and there is no possible help in the neighborhood. What is to be done?

Send the clothes regularly back to the laundry in the city—in suitcases the kind recently invented for this very purpose. In these cases one side is reversible, carrying a place for the name of the laundry on one side and the name of the customer on the other.

It Tells Time and Temperature

LOOK at this clock and you see not only what time it is, but also how hot or how cold is your room. Often temperature is more important than the time. But why not have a combination thermometer beside the clock?

An ordinary thermometer will simply tell the temperature. It will not indicate whether the temperature is going up or down; but the little recording thermometer will.

Its construction is extremely simple and one of the cards over which the needle draws the record of the temperature changes will last a week. Thus you can look over the record and know the past week's temperature.

This Crossing Signal Acts Like a Watchman

THE automatic watchman pictured here never goes to sleep, and is always on the job ringing a gong and flashing a light when a train or trolley is approaching.

When the train reaches a certain point on the track a circuit is closed, and the bell rings and the light flashes. This warns automobiles and wagons of the approaching train. After the train has passed, the signal is automatically turned off and is ready to sound and flash a warning when the next train approaches.

Keeping a Felt Hat in Shape

SOFT felt hats soon lose their shape if they are not equipped with some sort of shape-retainer. Every time you put your hat or take it off you bend it accidentally, and felt wrinkles.

Above you see a hat into which a metal backbone is being placed.

It was invented by Henry Rust of Hopewell, Virginia, and consists of two steel wires held together at the ends by flat pieces of sheet metal.

These wires are very flexible and will fit snugly beneath the two peaks of the hat keeping it in shape neatly and invisibly and without any inconvenience to its wearer.

Grind Bones for the Chickens

DO you keep chickens? If you do, you will be interested in this bone-grinder, which may be installed in the coop or woodshed. Bones left on dinner-plates are saved, and after they are put through this little crusher, they come out in a pulverized condition suitable for the chickens.

The grinder is small but sturdy, and as a grinding unit it is indeed powerful considering its size.

The grinder element is turned by a crank, while the bones to be ground are held against the revolving member with the lever shown.

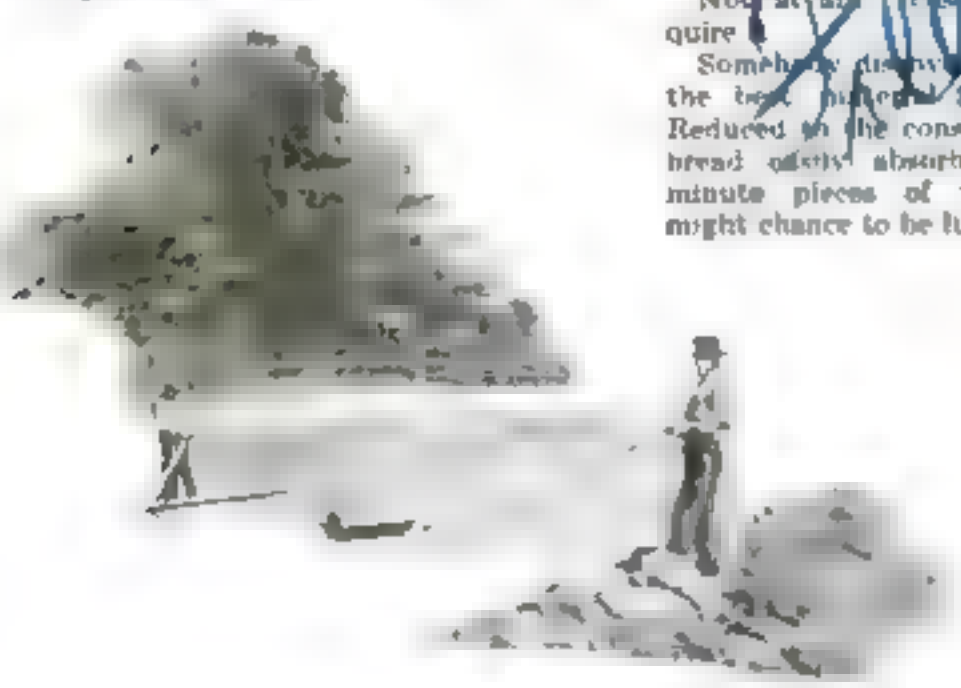
After the bones pass through the grinder, they drop into a little pan in the base of the machine.

Making Concrete Rough

A ROAD-BUILDING engineer, John B. Hittell, thought of the idea of building an asphalt road with a concrete base. It was necessary to roughen the concrete while it was impressionable so that the asphalt covering would cling to it more tenaciously.

A small roller with sheepings attached to its surface was used. Two men, one on each side of the road, drew the roller back and forth across the road with two ropes in the manner illustrated below.

Thus the necessity of treading on the soft concrete was avoided.



Two and a Half Miles of Rope on This Hoist

IF one hundred and forty-five people were placed in a huge bucket, this gigantic hoist would be able to lift the load at a speed of thirty-two hundred feet a minute. It is a husky brute, the largest of its kind in the world.

It is driven by a large steam-engine. The rope, which drops into the mine-shaft where the hoist is used, coils itself around the huge drum shown above. The rope capacity of the machine is 13,300 feet—over two miles and one half.

With the aid of this hoist the ore from the mine is hauled to the surface as fast as the miners can mine it.

Speed is a great consideration in mining to-day, and this hoist will certainly speed up the work in any mine.

How Watches Are Cleaned

ONE of the large watch factories of the country has a standing order with a bakery for forty loaves of bread to be delivered each day. What for? To feed its workers?

Not at all! It is the watches that require it.

Somebody discovered that fresh bread is the best material for cleaning watches. Reduced to the consistency of dough, the bread easily absorbs oil and takes up minute pieces of foreign matter that might chance to be lurking about.

Spraying Perfume on the Passers-By

YOU never know whether you like a thing until you try it. Take perfumes, for instance. One whiff is enough to let you know whether you like it.

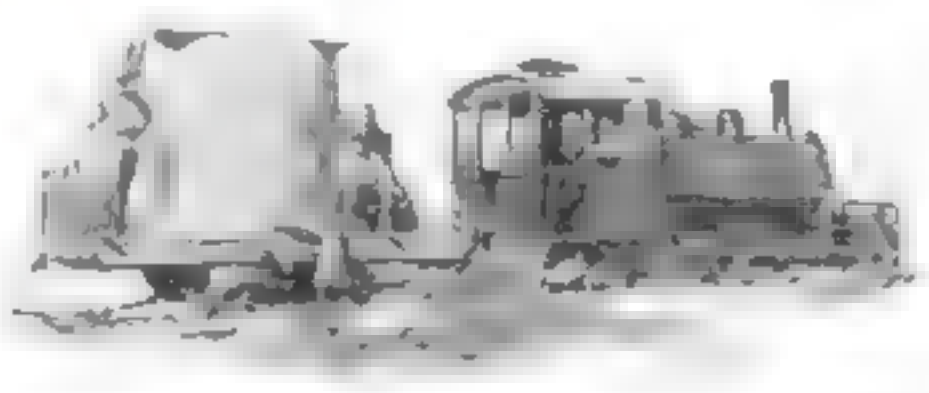
A Chicago manufacturer, realizing this, decided to give passers-by the necessary whiff. He inserted an electric fan in his glass show-window and placed a felt disk, saturated with perfume, behind it. As the blades of the fan revolved they sent the perfume-laden air into the street.

Hogs Fed by Railroad

BECAUSE a jerkwater railroad company failed, a California rancher bought an eighteen-ton steam locomotive, some small flat cars, and five miles of regulation track. On one of the flat cars he mounted a wooden tank having one thousand gallons capacity, and in it he placed agitating paddles operated by the locomotive. What does he use the tank for? Mixing hog feed. The feed is dumped into the top of the tank from a second-story platform and is mixed thoroughly with water, the revolving paddles reducing it to a sloppy mixture.

The railroad track is laid along a central feeding alley, on both sides of which are hog-feeding troughs so arranged that each animal is provided with a private dining-table. The front end of each pen is equipped with a swinging gate that is operated by a trip lever. When the lever is tripped the gate swings outward at the bottom and rests against the outside wall of the feed-trough. This gives the hog access to the feed.

At the side of the tank-car is an extendable metal feed-pipe that terminates in a four-inch rubber hose. A lever controls the opening or cutting off of the supply.



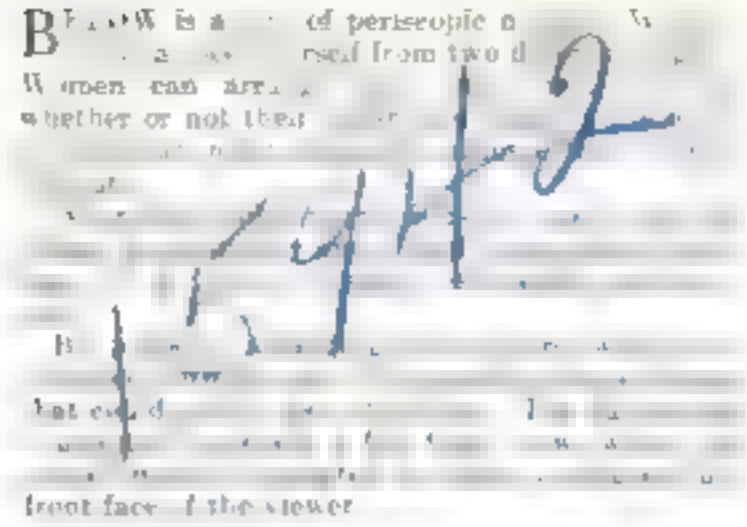
Shifting Belts without Any Danger

MACHINE belts must be shifted from one pulley to another.

A perfect alternating action of the upper and lower belt guides essential to shifting belts on cone-shaped pulleys is performed by this belt-shifter. The action is obtained without the rings or friction-producing mechanism.

The complete shifter is supported and actuated by the connecting-shaft. Universal brackets permit its application to almost any machine without drilling holes overhead or in the machine. The belt-guides of the device are held firmly sidewise by an automatic gravity lock.

The Mirror that Sees Double



BROW is a [illegible] of periscopic [illegible]
[illegible] reel from two d[illegible]
Women can [illegible]
whether or not they [illegible]

[illegible]

[illegible]

[illegible]

front face of the viewer

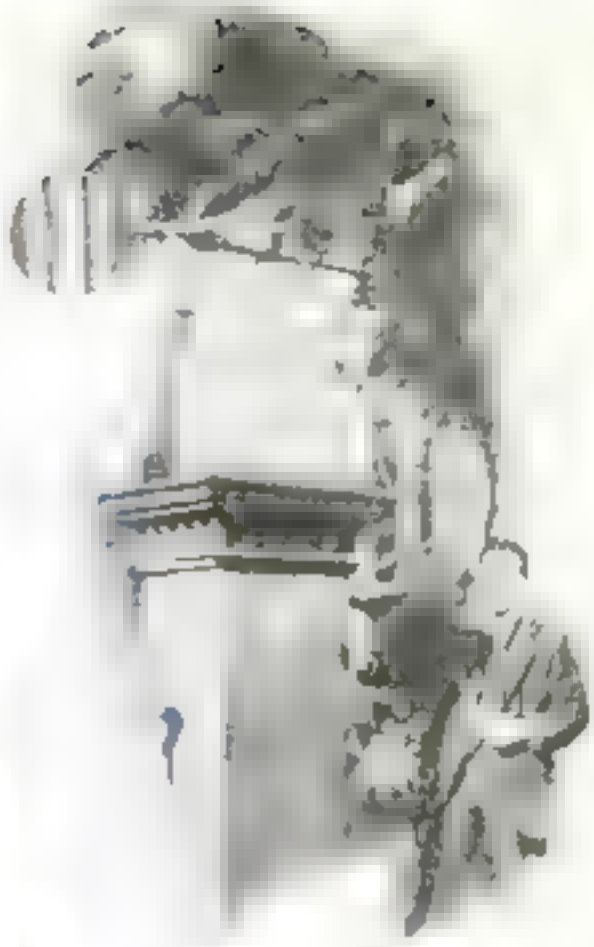
What the Farmers Are Up Against

HOW to make his life work pay in the face of what the Department of Agriculture calls "hazards of production"—that is the problem that faces every farmer. What are these hazards? Plant and animal diseases, insect pests, predatory animals, rodents.

In 1919 field diseases, the Department reports, were responsible for the loss of millions of bushels of oats, corn, potatoes, and wheat.

Wheat rust is a powerful enemy of the farmer of the Middle West. Science has found that the fungus responsible for this disease gets its start in the spring in the barberry plant. A campaign has therefore been started throughout the country to eradicate the barberry.

If you are an American farmer, you may rest assured that your government is doing everything in its power to make your business a success. If you want advice, write to the Department of Agriculture, Washington, D. C.



An Unusual Way to Signal the Taxicab

IN England a certain hotel employs an unusual method of hailing a taxicab. It might be called a semaphore system.

When a cab is not wanted, the signal is down and out of sight. When a cab is desired, the string is pulled from inside and the semaphore goes up. A passing driver sees it and stops his car.

Express companies in this country use a similar system. They provide their patrons with a sign to place in the window.

He Built a Car in the Kitchen

ALBERT PELZEL is an automobile mechanic. He decided to build an automobile but had no workshop, so he used the kitchen. The motor and wheels were bought in a motorcycle shop. The hood was taken from an extinct flivver. The body was made from the roofing of a wrecked freight-car. And the entire car cost less than a hundred dollars.

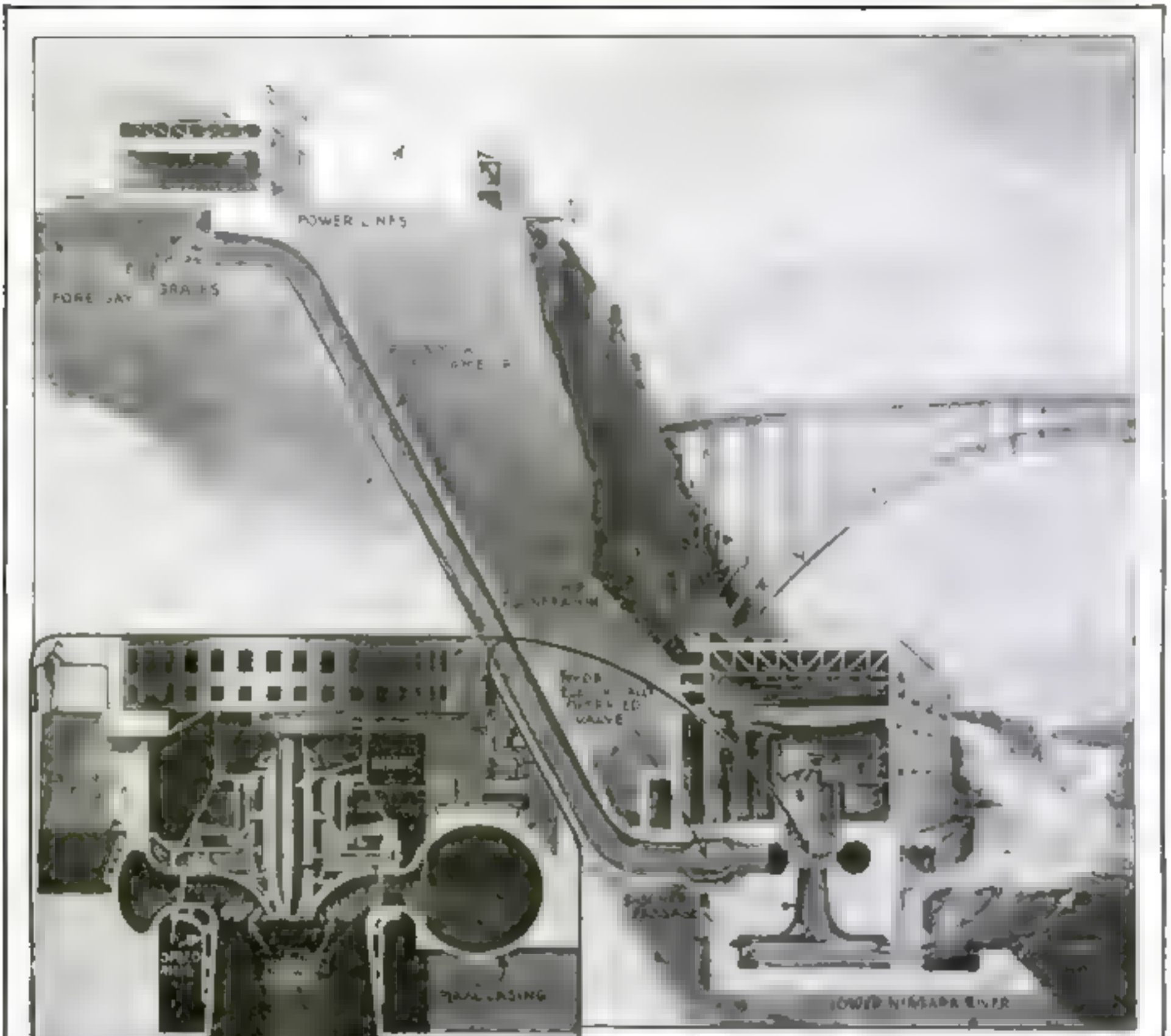
How will Mr. Pelzel get it out of the kitchen? By taking off the wheels and axles, and lowering the body out of the window.

Weeds Killed with Chemicals

RAILROAD engineers do not like grass or weeds to grow between the tracks. They spend many thousand dollars annually to prevent and destroy the weeds.

The chemical weed-destroyer, pictured sprays a deadly (to weeds) chemical on the weeds that effectively prevents their growth. This is found to work better than the mechanical weed-pulling devices that have been used by the railroads heretofore.

The chemical used is clean, odorless, non-explosive, and harmless to the skin if it is washed off in a reasonable time.



A cross-sectional view of one of the big turbines. The water rushes into the circular casing, spends its force against the runner, and passes out through the center

Mounted on the shaft of the turbine runner is the revolving member of a 37,500 horsepower electric generator. The water drops 210 feet before it rushes into the turbine casing. The three generating units of this installation produce more than 100,000 horsepower

Another 100,000 Horsepower from Niagara

Produced by three giant generators

THINK of a straining line of horses extending from New York to Philadelphia and you will have a good idea of the amount of power furnished by one of the big electric generators recently installed in one of the large power plants at Niagara Falls, New York. Each of these spinning giants produces 37,500 horsepower

Water-power is generated by permitting a great volume of water to fall from an upper level to a lower level. In this case the upper level is the Upper Niagara river and the lower level is the Lower Niagara river. The difference in height at the point where the water is allowed to drop through the gigantic penstocks or pipes is about 210 feet. A power canal runs around the falls and brings the water to the mouths of the large penstocks at the brink. A solid column of water 18 feet in diameter rushes down the penstocks at a speed of about three miles a minute.

At the end of the great steel penstock tons and tons of water spend their force against the blades of a turbine wheel. This wheel revolves in a horizontal plane, and connected with the upper end of its shaft is the revolving member of the big electric generator that converts the kinetic energy into electric energy

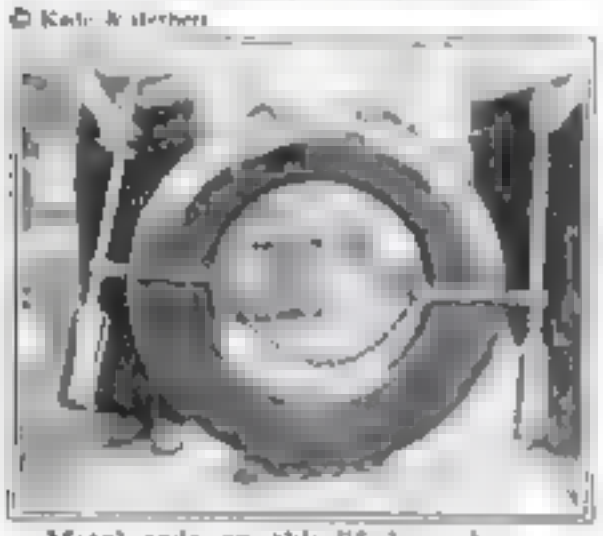
The water rushing into the penstock is caused to whirl around at a terrific pace. It rushes out at the center and passes into the river. A huge valve is located at the bottom of the penstock, and the water passes this just before it rushes into the turbine. This valve is hydraulically operated and electrically controlled. The big valve, weighing several tons, is moved forward merely by closing a switch, when it cuts off the flow of water in the penstock

The lookout presses a button, which immediately releases the life buoy

The Life-Buoy that Flares in the Water

"MAN overboard!" Hearing the cry, the lookout presses a button. Several life-buoys drop to the water. As they strike, torches flare.

These buoys are of copper, fastened to opposite sides are metal rods that have an open-net perforated compartments containing calcium carbide. The rods turn on pivots. As the calcium carbide comes into contact with the salt water, the acetylene gas generated bursts into flames, which usually lasts until the buoys are picked up.



Metal rods on this life-buoy become torches when the buoy hits the water

All the Thrills without the Danger

IF you have felt the high cost of airplane rides to be a serious bar to pleasure, here is the airplane railway for you.

You board this lifelike-looking airplane comfortably from a platform reached by a stairway. The airplane swings out into the air in a most realistic manner if you do not notice the track.

The track, however, is important. It is a monorail that firmly supports the airplane

Trolleys that Have No Tracks

TROLLEY-TRACKS are very much in the way. Hence the trackless trolley-car is now coming into use. The car gets its power from an overhead wire by means of the usual trolley-pole. The motorman must steer the car, as well as control the power and brakes. His job is harder than that of an automobile driver, for he must make his car follow the straight and narrow path under the wire—if not the pole will break away.

Can a trolley car do without tracks? This picture answers the question. In the motorman's box is a steering wheel that keeps the car in place beneath the wire

Strangely, one of the first of these advanced trolley-cars appeared in Tokio, where the jinrikisha is still in vogue. The car itself is not unlike our American trolley cars, it has, however, a large wire fender in front to catch anybody who fails to get out of the way.

In Bradford, England, another trackless trolley-line is in operation. The cars look like two-story buses, and have the usual hard rubber tires. The current passes through an electric motor, which drives the rear axle through sprocket wheels and chains. How, then, is the current from the trolley-pole grounded? By means of a second trolley-pole, which carries the current back to a second wire, on to the power house. When tracks are used, they carry off the current.

One advantage of the trackless system is that it eliminates blocking.

Helping the Aviator to Find Himself

With the assistance of the chronometer and sound waves

By P. J. Risdon

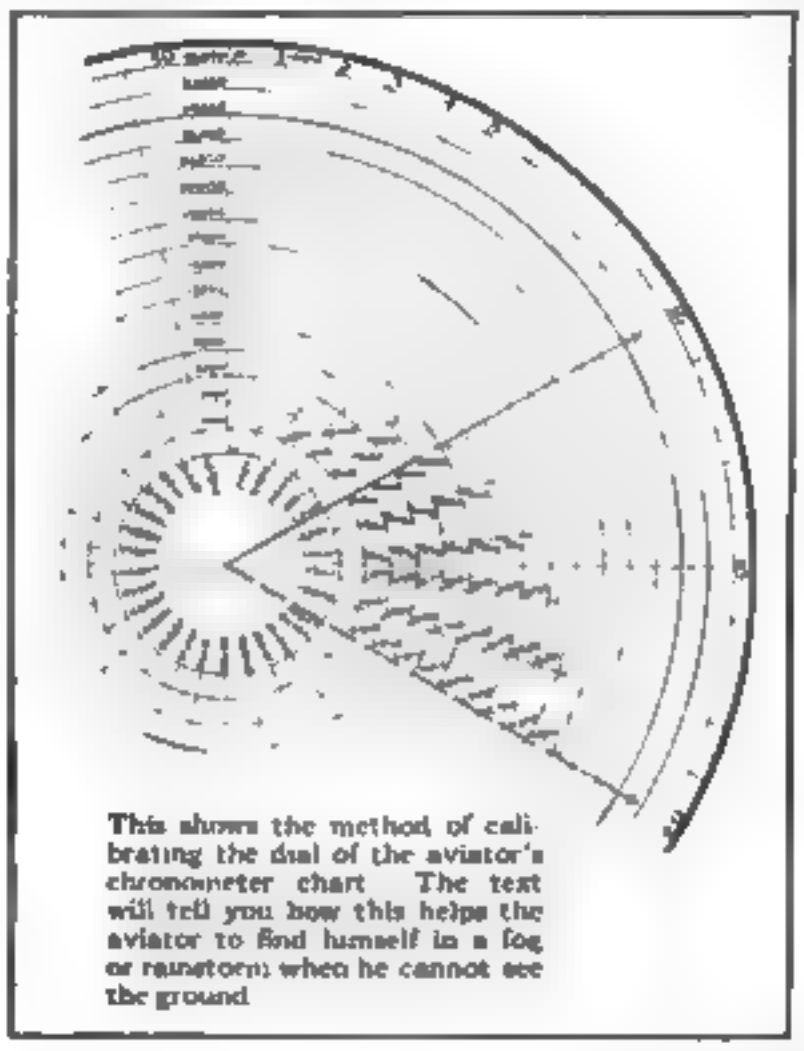
English correspondent of the Popular Science Monthly

ONE of the principal difficulties that confront an aviator is that of ascertaining his position and altitude when flying through or above clouds or in foggy weather. Another is to locate a flying-field and to land there in a fog. Since, in employing aircraft for business and mail-carrying, flying must go on in all weathers, means must be found for doing so in safety.

The great advances made in the adaptation of wireless telegraphy and telephony to aircraft have temporarily overshadowed the possibilities of sound-ranging, but Professor G. H. Bryan has recently revived the subject. His report merely outlines his scheme of applying sound so that an aviator will know his position and altitude at any moment

The scheme comprises two elements. By means of the first, an aviator following a recognized air route would be directed by sound signals received from base stations established along the route, the correct interpretation of which would enable him to take his bearings every minute and thus know within a reasonable margin the course he is pursuing.

The second element is based upon the time taken for the sound of an explosion, caused by the pilot on or just beneath the machine, to reach the earth and rebound to a receiving instrument on the airplane. At the present time an airman has no means of ascertaining his height. His altimeter records only his height above sea-level, and is set according to his base station. Consequently, unable to see around or below him, he may at any moment foul rising ground or buildings. Detonations produced by the pilot himself would render him independent of ground signals.



This shows the method of calibrating the dial of the aviator's chronometer chart. The text will tell you how this helps the aviator to find himself in a fog or rainstorm when he cannot see the ground

Can Sound Be Depended Upon?

Expert opinion is divided as to the practicability of effectually guiding aircraft by sound. Only experiment can determine to what extent accuracy would be impaired—for instance, by banks of cloud of varying depth and density and with gaps or "holes" in them.

Let us suppose that a pilot is flying in cloud or fog, and that his altitude is 1100 feet. His altimeter may register a height of 3000 feet from his base station, so that, without knowing it, he has reached hilly country. He now fires a detonator, and (ignoring for the moment the difference between the speed of sound in cloud and in clear air) the sound will take two seconds to reach the earth, rebound, and be detected by his microphone.

Assuming the speed of sound to be 1100 feet a second, he will thus know his altitude. By firing a succession of detonators he will keep himself acquainted with it, and fly accordingly

At present sound signals from the airplane are picked up by receiving stations, from which guiding wireless messages are then despatched and received by the airman. Professor Bryan proposes to make the airman independent of wireless. He therefore proposes that along every air route there should be established stations that will emit sound signals at intervals of one minute. The stations will be spaced several miles apart, and arranged triangularly, that is to say, so that straight lines joining any three of them will form a triangle. As the airman proceeds, he receives these sound signals at intervals of time, varying in length according to their distance. The detonations at different stations may vary in quality or intensity, to lessen the risk of confusion. The upper left-hand figure on the opposite page indicates the position of an airplane ascertained in this manner. *A*, *B*, and *C* are three stations, and the black dot indicates the position of the airplane.

If it were on the ground, the three curves of the 4-, 5-, and 6-mile radii would all intersect at one point, which would be its position. But since it is not on the ground but in the air, the sound waves rise, forming, as it were, an imaginary irregular pyramid with a triangular base. By drawing lines from the intersections of the curves perpendicularly to lines joining the stations, it will be found that they intersect at the position of the airplane. It is then merely a matter of trigonometrical calculation.

Enter the Chronometer

But Professor Bryan does not expect an airman to perform trigonometrical feats. He proposes a simple device by means of which the second-hand of the pilot's chronometer will indicate his position in regard to the three base stations.

All the chronometers at base stations and on the airplanes would be set to standard time. Around the second-dial of each pilot's chronometer would be circles graduated in miles. The distances apart of the circumferences represent heights in feet, the graduations round the innermost circle represent horizontal distances at ground level, and the graduations of the other circles represent *horizontal* distances at various levels up to, say, 33,000 feet.

Now, all the stations would send out their sound signals at an exact minute, and according to his distance from each station the sound would take more or less time to reach a pilot. If by his altimeter or by the method already described he had ascertained his altitude to be 2200 feet and then heard a sound signal just as the second-hand of his chronometer pointed to two seconds past the exact minute, he would know that he was over the station, because the sound would take two seconds to reach him.

Drawing by G. H. Davis

Guiding Airplanes by Explosions Recorded on a Chart

This system of locating an airplane is based upon the time taken for the sound of an explosion, set off by the pilot of the airplane, to reach the earth and rebound to the airplane. The altimeter now used merely indicates the height of the machine above sea level.

The airman can locate himself by receiving sound waves set up by three sound producing stations arranged in a triangle. These stations would be placed several miles apart and they would emit signals at intervals of one minute. As the airman proceeded he would receive this sound signal at intervals, varying according to its distance.

By watching the chart of his chronometer, the airman can determine his exact position.

The Government's Method of Testing Tires

NO mercy is shown when automobile tires are tested at the Bureau of Standards. Tires are purposely run until they are fit for nothing but the scrap heap, but the data that such tests make available are worth many times the cost of the tires used up in the tests.

The tire-test machine shown above was designed especially to measure the power lost and energy dissipated by heat generated in the tire through friction and slippage. With this arrangement the pressure of the tire against the wheel with which it is in contact may be measured.

Live Wires Covered by Blanket

INVENTORS have recently turned their attention to the protection of electrical workers, and many devices that reduce the hazards have found their way into the market.

Below is an insulating blanket to be used to cover "hot" wires and prevent accidental contact when a workman is making repairs on wires adjacent to the live wires. It is simply placed over the live wires and zipped together at the bottom with two pins to prevent it from falling to the ground.

It Folds Like an Umbrella

AIR makes grown folk sleepy, so it is not surprising that babies want to go to sleep soon after they reach the beach. But how can you protect baby at the seashore from flies, ants and other insects?

Above is shown a new collapsible canopy that will fold up and fit in a narrow case just as if it were an umbrella. When extended it is large enough to accommodate a cradle. The net that entirely covers the frame will keep out all flies and bugs. Such a cover as this will relieve parents of much worry when taking the baby to a picnic or to the seashore.

How Small Is a Hummingbird?

THESE two young ruby-throated hummingbirds represent the smallest species of feathered life inhabiting eastern North America. They were found one June day in a sugar-maple tree in Pennsylvania.

The discoverer standing by, almost without breathing, saw the mother bird bring her babies food, thrust her long beak down the throats of each youngster and empty her beak of the nectarous juices that she had carried from a flower-garden.

The young birds were photographed near a fifty-cent coin to show their size.

Strangely enough, when the picture was being taken the little birds thrust out their slender tongues in rapid succession.

Breaking Up the Cream in Milk

"SHAKE well before using." That holds good for milk as well as for medicine. If milk stands an hour or so, all the fatty, creamy part rises to the top, leaving the watery part below.

Now, however, there is a machine that will break up the cream globules so thoroughly that they can never come up again. Thus the richness will be distributed throughout the milk.

There are four agate needle valves on the machine through which the milk is forced at high speed. As it rushes through a valve the fat is broken up.

Tickets Printed While You Wait

WE know the world moves fast. So do ticket-sellers of some European railroads. They print your ticket while you wait.

You tell the man your destination, and he disappears for a few minutes and returns with your ticket. Having printed it in the meantime. He hands it to you while the ink is still fresh.

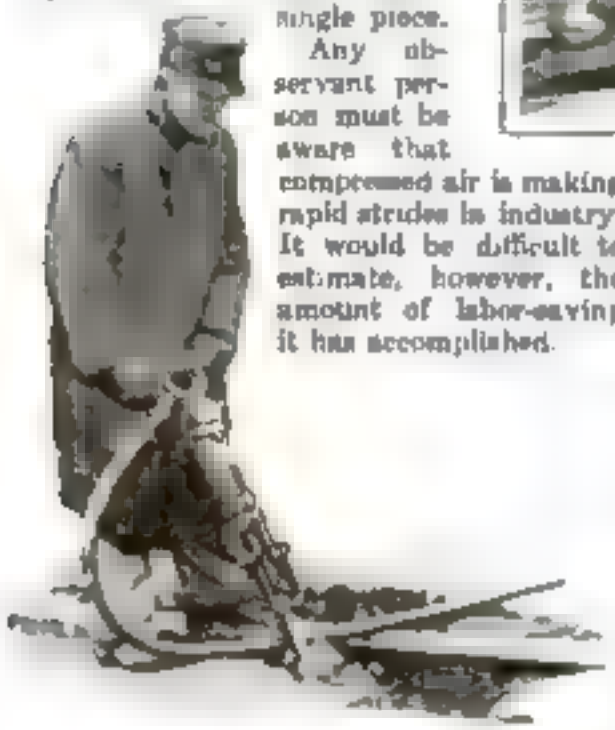
With railroad rates and schedules changing as they do nowadays, this ticket-printing machine has filled a much-felt want. There is no wastage, since every ticket is printed to correspond with the conditions to be met at the time it is printed.

The Air-Driven Pick Is Easy to Use

IS the old "hand-driven" pick doomed? Here is a modern pick working as modern things should work—by compressed air.

This old man has thrown his hard pick away. His air-driven pick is especially efficient at tearing up old asphalt pavements, and it is after that work in the picture. Within a man can dug up a square yard of pavement in three minutes. Only a small fraction of this amount could be dug up with an ordinary pick. In fact, it often requires this time to dislodge a single piece.

Any observant person must be aware that compressed air is making rapid strides in industry. It would be difficult to estimate, however, the amount of labor-saving it has accomplished.



Leggings to Protect the Foundry Workmen from Burns

WORKMEN in foundries are constantly handling molten metal and precautions should be taken against the serious burns that frequently occur. A drop of metal will penetrate clothing and scorch the flesh. Leggings made of asbestos treated duck have been found very effective in preventing injury. The material is highly glazed and the molten metal will not cling to it.

The leggings worn by the men in the picture above are constructed around spring-steel frames; there is an inside and an outside covering. The leggings snap on

Putting Tools Where They Are Needed

ANY automobile driver will testify that garage mechanics spend most of their time going back to the store-room to get the tools they need.

To obviate this, a device has been devised by a Los Angeles garage-owner that is equipped with every tool that could possibly be needed in electrical trouble-shooting and repair work.

This is really a complete store-room in itself, being arranged with drawers for supplies and tools and other necessary apparatus. It is mounted on wheels and is easily moved to the car to be repaired. The mechanic has any tool he wants right at hand.

The picture below shows this useful truck.

France's Population Normal in Seventy Years?

FRANCE lost several million men during the war. Professor Richard Strong, of Harvard, claims that it will take France seventy years to bring her population back to normal. Which means that in the year 1991 France will have a population that will compare favorably with the population she had before August, 1914.

A reduction in population means a reduction in income. It would be interesting to know how much the war cost France with this item included in the actual expense.

Chickens Singed with Acetylene

ONE of the most recent uses for acetylene is for singeing chickens. It is said that the acetylene flame, properly used, performs this operation in a small fraction of the time usually required, that it removes the last vestige of feathers from the fowl, and that the burning off is accomplished without scorching the skin or heating the delicate flesh.

This is no more remarkable than the use of acetylene in removing paint from canvas, which is done without even the slightest injury to the fabric.

He Carries His Own Telephone Wires

LINES of communication are established in the vast wooded tracts of forest preserves by means of fine wire carried on portable reels. Lightness is of prime importance, for the man must sometimes extend considerable distances, especially when a fire is being fought; the progress of fire-fighters must not be hindered by any lack of communication.

In order to make means of communication more certain, the United States Forest Service makes use of small reels such as the one shown in the illustration. The forester can carry it without impeding his progress, and he unwinds or winds up the wire as he follows the trail, looking out for indications of fire.

Folding Screen Chair for the Garden

GREEN trees, blue sky, golden sunlight—for all these it is easy to give thanks. But caterpillar, ant, and mosquito have a habit of distracting one's thoughts from higher things and dictating a swift retreat to the screened porch.

Which is one reason why Stephen Stransky, of Darby, Pennsylvania, invented his screened chair. It is a very comfortable chair, for besides being screened, it has arm-rests, a book-rest, and rockers. As if this were not enough, the chair, rockers and all, can be folded up into a compass not much larger than an ordinary door.

The hinges are of the removable pin type, so there is little difficulty in unfastening the parts.

Protect the Ice-Cream Cone

ICE CREAM in the cone is good eating, the cone as well as the cream, but many people dislike to eat cones that they know it has been handled. Now, however, there is a cone-holder that protects the cone both from too much hand-rubbing and from dust.

The [illegible] are made of metal and glass, [illegible] holds fifty. The [illegible] four [illegible] of metal, hinged together.

When there are no customers present, of course the case is closed. But while [illegible] in operation, the metal [illegible] opened [illegible] picture above.

There is a narrow perforated shelf attached to the front of the case in which filled cones are placed ready to be eaten. In this manner, the danger of disease from germs is considerably lessened.

How Sandbags Save the Lives of Aviators

TESTING airplanes by the sandbag method is a very severe method, to be sure. In fact, it is testing them to death.

Hundreds of little sandbags are placed on the wings until they crash under the load.

At this time the aeronautical engineer may find just where the first sign of weakness manifested itself. Then he gets out his slide rule and mathematical tables, and figures out a remedy.

Oftentimes it is merely a matter of tensile strength, but it may be a matter of faulty design. In any event, the sandbag weight test brings out the point of weakness, wherever it may be.

Of course, this method of testing is not applied to every new machine. It is used only when the first machine of a new class has been made.

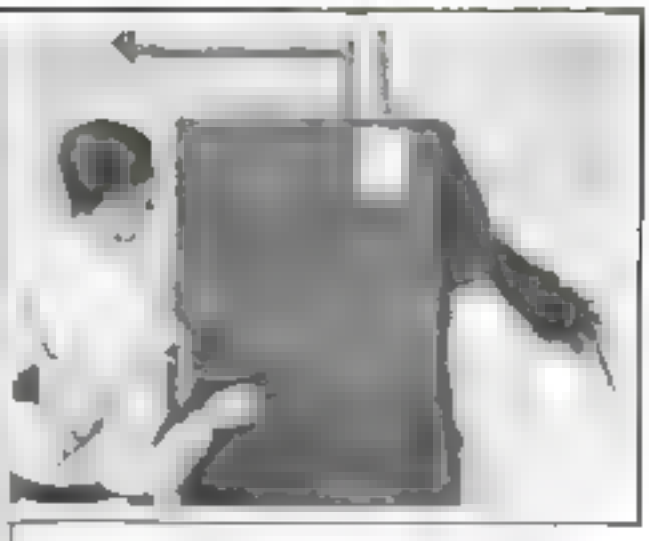
Moving a Large Camera Piano Fashion

SO large was a color-process camera bought recently by a Washington, D. C., engraving plant that it would not fit in the elevator of the building. Four men, operating a block and tackle, raised the camera to the roof and lowered it through the skylight to the fifth floor, where the company has its operating-room.

The camera takes a picture thirty inches square, the bellows are more than ten feet long. The camera is equipped with a special stabilizer frame to obviate risk of damage to the immense plates by reason of vibration during exposure.

The camera will be assigned to do color jobs for the federal government, and is already engaged in producing the colored designs of the official publication of the United States Chamber of Commerce. The lenses of the apparatus are complete, with filters for blocking out colors on two-, three-, or four-color half-tone assignments, permitting accurate reproduction of oil and water-color paintings.

The machine, including accessories, cost approximately three thousand dollars. The brilliant illumination that is focused on the object being reproduced has twice the strength of the light available for a camera twenty by twenty inches in size.



Beauty at Any Cost

MOST of the apparatus of a beauty parlor looks like instruments of torture to the unaccustomed eyes of [illegible].

It is safe to say that some of the results obtained have been at the cost of physical discomfort.

[illegible] steam is turned on to the lady's face, which is encased in a [illegible]. The steam is at comfortably hot temperature to expand the skin and improves the circulation of the blood.

The result of the treatment is said to be [illegible].

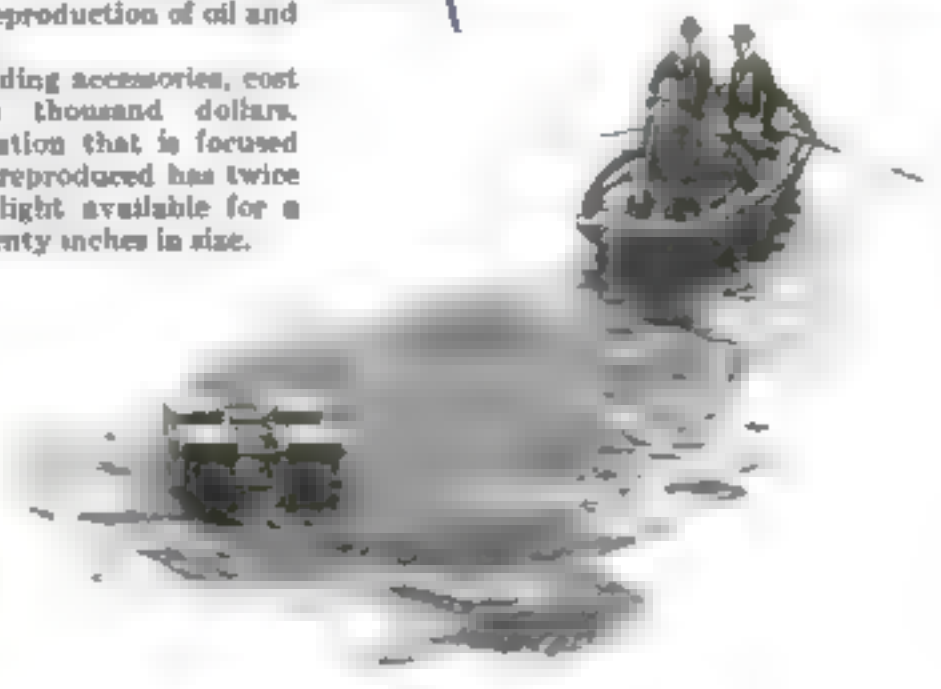
An indicator outside the box shows the temperature within, and the steam is admitted gradually until the right degree is reached.

All Conveniences on This Life-Raft

LIFE-RAFTS for ocean-going vessels are as numerous in design as are the designs of non-refillable bottles and rail joints. Below is still another, however, that appears to "fill the bill."

This raft is a square wooden framework, and at each corner is a water-tight tank fitted with a patent air-shaft for the accommodation of passengers. Between the tanks are chambers for the storage of food, clothing, heating apparatus, a sail, and wireless telegraph apparatus.

The raft is placed upon the deck of the vessel, and in the event of a shipwreck it is simply rolled off into the sea. The picture shows the inventor trying a model of his raft on the Thames river at London, England. White mice were used in the experiment.

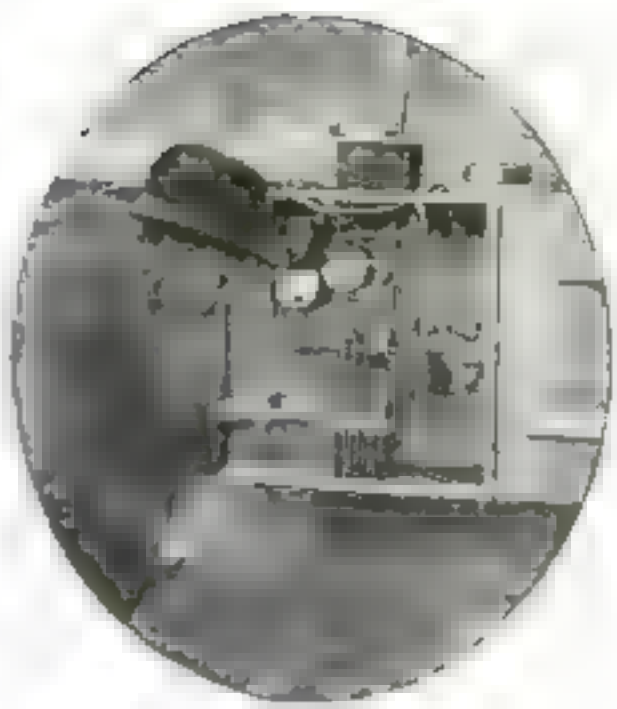


Efficiency in Hay-Wagons

TWO men, after driving this hay-truck from the farm or railroad-station, can, unaided, deposit their bales in a loft.

The structure of the truck is shown clearly in the illustration. While the chassis is of the regulation type, the body is a hay-carrying model. The part that is unusual about the motor-truck is its lifting apparatus, which, with the action of two powerful arms, will lift the body and its contents six feet above the chassis.

When the wagon is empty, the arms slowly fold and the truck resumes the appearance of an ordinary truck. With such equipment labor is not such a serious matter with the farmer of to-day.



A Megaphone-Fan for the Baseball Fan

"YOU swing at it like a gate!" shouted the exasperated fan through a small cardboard megaphone.

He was hot under the collar, and then he opened up the megaphone, slipped it in a wooden frame, and fanned himself with it.

The batter in the meantime grew peeved, swung at the ball, and scored a run. Whereupon the fan who was fanning himself recorded the run on the back of the fan. Do you get it?

This combination megaphone, fan, and score-card was invented by George K. Asano, of Dalhart, Texas.

Electric Lights from the Water System

WHEN the faucet is turned on water flows through the pipes. If the moving water is allowed to pass through a small water-motor or turbine, a certain amount of power will be generated without lowering the water pressure undesirably.

A French scientist named Colardeau has invented a system for generating electric current, and feeds it to a storage battery every time the water in the house is turned on. The current in the battery accumulates from day to day, and may be used to light several small lamps.

Of course, this method supplies only a small amount of current.

Make Your Bed in the Car

PRICES charged by hotels have caused many an automobilist to make his own bed.

But when you are touring all day you really should have a comfortable bed at night. There is now a regular spring-bed that can be erected in a few minutes inside of the car itself.

One end of the bed-spring is clamped to the back of the car. The other end is attached to the wind-shield by means of iron triangles. There is practically no strain on the wind-shield, for ropes extend from the opposite angles of the triangles to the front mud-guards. The pull in each direction is the same.

Mining for Gum

MINING for gum is a great industry in the North Island of New Zealand. It is not chewing-gum, however, but a resin varnish gum that is the residue from prehistoric forests.

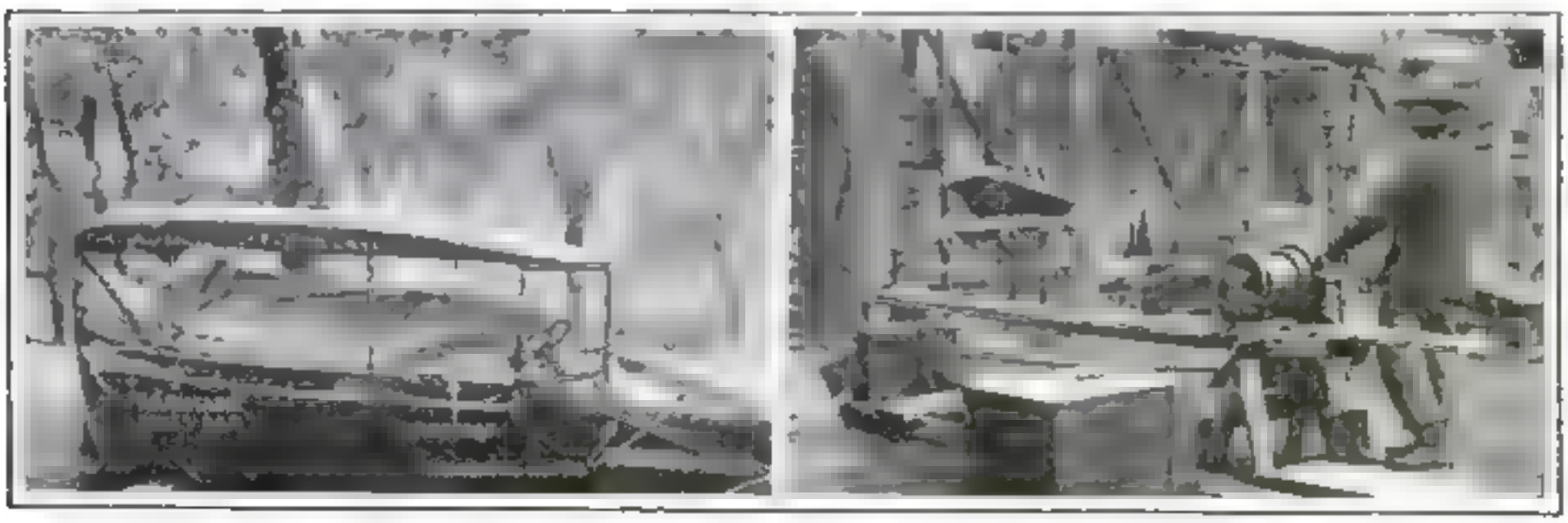
This fossilized resin is found a few feet below the earth's surface, and the miners dig it out with pick and shovel. This is a sort of free-lance occupation, and many men have made small fortunes in this digging. The gum has many uses, the principal of which is in the manufacture of varnish.

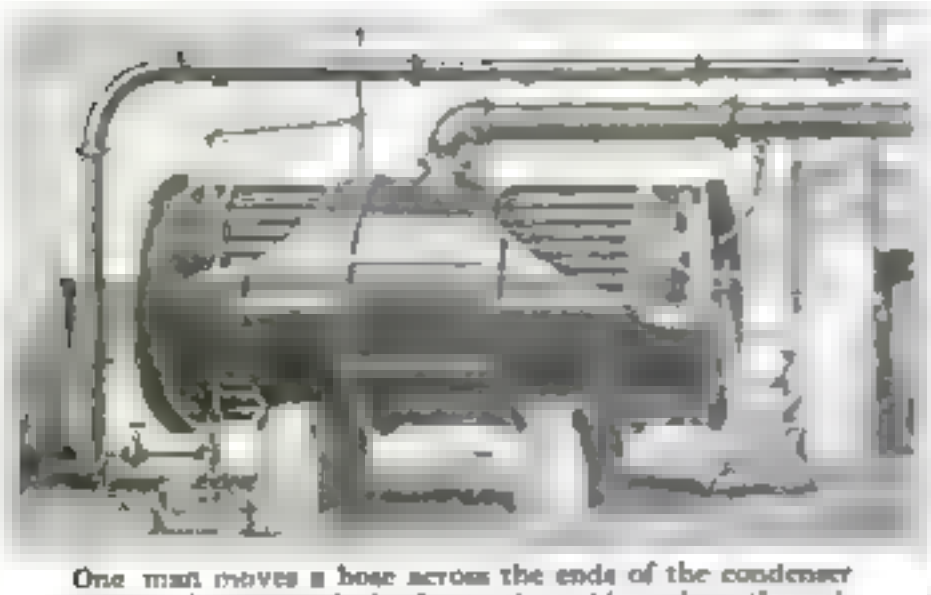
Air- or Steam-Driven Tugger

IN industry there are a hundred and one uses for the little machine shown below. It is a jack-of-all-trades when it comes to tugging and lifting. It may be used in place of a hoist or a horse, since it will both pull and lift.

Here it is shown lifting a wheelbarrow of bricks up to the fifth story of a building under construction. It is fed with compressed air, although steam may also be used. There is nothing to do but pull over the throttle.

The machine is small and so powerful is it that it is used to move loaded freight-cars when the switch-engine is not available.

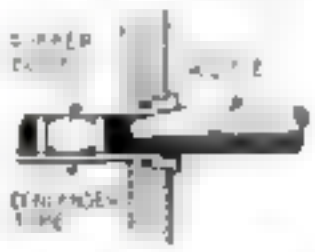




One man moves a hose across the ends of the condenser tubes. Compressed air shoots the rubber plugs through

Tubes Cleaned with Bullets

HOW much time would it take one man to clean out nine thousand long metal boiler tubes? It would be such a task that the power plants where surface condenser tubes had to be cleaned formerly put six or eight men at work on the job, and even then it took a long time, for the men had to do the work by hand. Generally they used wire brushes attached to long rods, running them in and out of the tubes until they were clean.



How the rubber "bullets" are forced through the metal boiler tube by compressed air water also can be used for propulsion

Steam turbines need these condensers to produce the vacuum into which the steam is exhausted. The higher the vacuum, the smaller the steam consumption and the greater the amount of fuel saved. Clean tubes insure high heat transmission and consequently a maximum vacuum. Thousands of gallons of water are pumped through the cooling tubes of the condenser, and small particles of debris finally coat the inside of the tubes. This coating acts as an insulator, and must be removed.

One workman can now clean the condenser with rubber plugs equal in number to about 25 per cent of the number of tubes. He places one plug in the end of each tube. Then he takes a hose that has a quick-acting valve, and moves the nozzle across the openings containing the rubber "bullets." Either compressed air or water serves to shoot the bullets through the tubes under a pressure of eighty pounds. A bucket placed under the drain-pipe at the bottom of the condenser catches the plugs.

Each plug can be used 250 times or oftener. Special plugs containing an abrasive mixture in the rubber can be used in cases where a hard scale is encountered. By the new method a vacuum two tenths higher can be obtained than with the hand method of cleaning, and a saving of more than 75 per cent in the cost of the work results.

The Telephone for the Deaf

ELECTRICITY has aided deaf people before this time, but this time it comes in the form of a telephone receiver so diminutive that it fits into the ear. It is the "Tom Thumb" of telephone receivers. Its size, although it might tend to reflect on its efficiency, does not affect it in the least. It reproduces speech perfectly. The diaphragm of the little receiver vibrates very close to the ear-drum, and a person would have to be extremely deaf not to hear it.

The microphone and batteries are carried in a leather case. This is called the "Tom Thumb" of telephone receivers

A very sensitive microphone and batteries are used in connection with the tiny receiver. These may be carried about in a small leather case. The microphone is a sensitive telephone transmitter. It picks up the sound waves and transmits them to the receiver, which is located against the deaf person's ear.

The entire equipment is light in weight and serviceable and efficient in action. Also it is not unsightly as to cause embarrassment to the wearer, a consideration to business men and women.

Six Thousand Trees in a Bale

THE United States government, as guardian of 174,261,393 acres of national forests, is replenishing denuded woodlands at a rate of seven thousand acres annually. Seedlings are nurtured in nursery beds, 150 trees to the square foot, with as much jealous interest as is evidenced by the professional nurserymen whose business

the West, from which the seedlings are distributed throughout the United States for reforestation of a supervised area equal in dimensions to four states the size of Iowa.

The largest of these tree-yielding beds, the Savenac nursery in the Lolo national forest of Montana, can produce three million plants a year. The young trees are baled and shipped to widely separated parts of the country. The government baler, here shown, has a capacity for compressing within single units for shipment, six thousand Western white pines.

At guardian of its national forests, the United States government annually ships millions of seedling plants to denuded woodlands. Young trees are compressed in this baler, which allows of sending six thousand pine-trees in a single unit

Community Ice

BY running its own plant, Lindsay, California, cut its ice-bill in half. The Chamber of Commerce bought a local plant, sold stock to three hundred citizens, and the secretary of the Chamber took charge.

The first season the plant manufactured one thousand tons of ice, at a saving of thousands of dollars.

How an Under-Water Steam-Whistle Is Produced

WHEN you talk, you cause the air between your mouth and the ear of your hearer to pulsate. Like air, water can be made to pulsate. If you strike a bell on the water, the sound will travel much farther than in air. Hence, many ships are equipped with bells, which are sounded under water and which are much more efficient than fog-horns.

Two English scientists, Mr. Gerald Stoney and Mr. Telford Petrie, conceived the idea that it might be possible to produce sounds under water by steam. After many disheartening experiments, they succeeded in devising a very efficient under-water steam-whistle which is an extremely convenient and cheap apparatus for producing loud, penetrating under-water tones.

Of course, these under-water tones, whether they are created by a bell or a steam-whistle, cannot be heard merely by putting the ear close to the water. An instrument called a hydrophone picks up the sounds. In the case of the Stoney-Petrie steam-whistle the sound can be heard four miles away.

In the first under-water steam whistle a steel disk, with a hole in the center, is supported on opposed knife-edges at two points only. Part of the steam shot against the disk from a nozzle passes through the hole; the rest mushrooms and then collapses. The alternate rising and falling of the mushroom produces a penetrating note

(a) Steam mushroomed by disk. Hot central core passes through hole. (b) Mushroom travels back from disk in form of a ring of condensing bubbles. (c) Ring collapses on and around the nozzle. (d) Onward rush of steam forms mushroom

The steam-whistle consists simply of a steel disk having a hole in the center for the passage of a steam-jet, and supported on opposed knife-edges at two points on a circle. The steam spreads out like a mushroom as it strikes the flat surface, the hotter central core escaping through the hole. The mushroom travels back away from the flat surface in the form of a ring or disk of bubbles. The ring collapses, but the onward rush of steam forms another mushroom as the previous one disappears.

This happens with great rapidity. Thus a musical note is produced by a series of pulses or blows of steam. It is not the vibration of the steel disk that produces the sound, but the rapid action of the condensing steam. This amounts to ringing water on water, just as we would ring iron on iron.

Clearing Stony Land by Machinery

A [illegible] that [illegible] yard of stones without any back-breaking hand work

EVERY farmer who has a [illegible]

This invention of a Bohemian engineer is made up of several rotating [illegible] which bite into the soil to a good depth, lifting up any stones in the earth and depositing them in a receptacle extending across the back of the apparatus. The operator merely drives the horses.

Stereopticon Changes Pictures Automatically

THE stereopticon has been modernized in the form of an automatic machine that takes the projected picture out of the dark room and permits its use for displays in show-rooms or windows. The perfected machine shows any number of lantern-slides up to fifty in continuous rotation in the daylight or night. The pictures change every seven to thirty seconds either automatically or by the pressure of a button.

This automatic stereopticon is designed for commercial display principally; the slide is first thrown on a mirror from which it is reflected on the front screen

The machine is made with two sizes of screens, respectively sixteen by fifteen inches and twenty inches square, and may be operated from an ordinary lighting circuit at a cost of four cents an hour.

The machine has retained its boxlike form, with closed sides, back, and top and bottom, with a screen in front at the top. The development has taken place in the mechanism inside for automatically picking up each slide in turn and elevating it so that its image may be thrown on a mirror at the back of the box and then reflected to the front screen seen by the observer.

The slides are held in order on a slanting framework and picked by a hinged mechanical finger device. One thirtieth horsepower operates the slide-selecting finger apparatus and a condensing system for daylight projection.

Peddlers from Petrograd to Cairo

Anything, even alligators and stoves, sold in the street

In spite of unsettled conditions in Warsaw people are still buying sponges, presumably to wash with. Here is a man who sells nothing but sponges and makes a fair living at it

Balancing a stuffed alligator on his head and carrying a turtle, this hopeful peddler roams the streets of Cairo. He sells other things chiefly beads

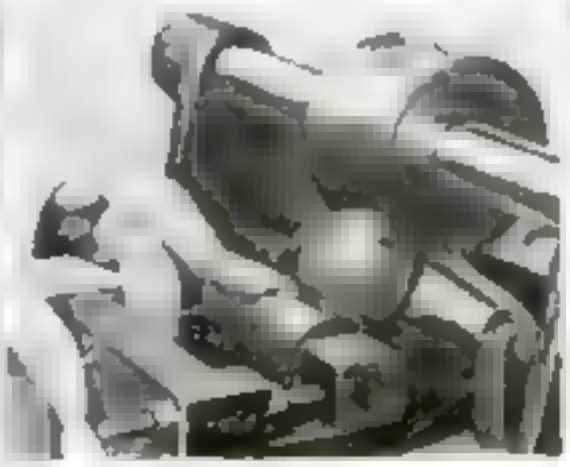
Evidently canes are fashionable in Constantinople, judging from the picture above, where all sorts of canes are shown also the Turkish peddler sticks to his fez

Golf-Balls and How They Are Made

From tiny pieces of gutta-percha they grow to the finished sphere

11-3-91

This is the first event of a golf ball's life: rubber tape is wound around a piece of gutta-percha. The winding is done by hand. In the winding the embryo ball becomes round

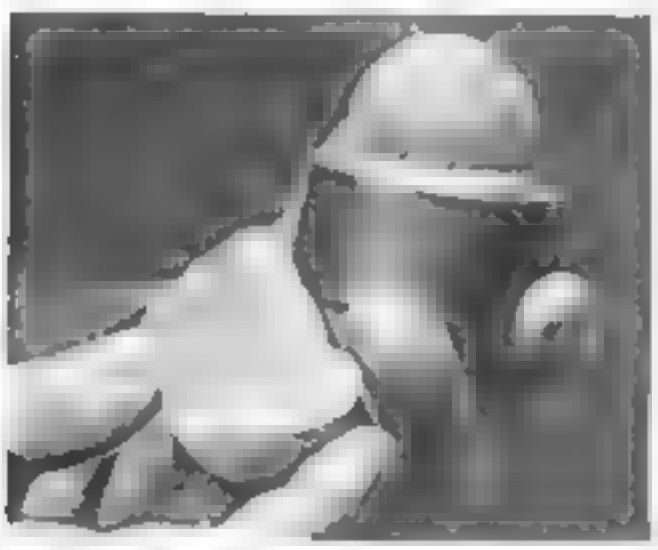


Into rubber thread is wound [illegible] with the help of [illegible]. The rollers revolve, carrying the ball with them, while the operator guides the rubber thread

The gutta percha shells into which a rubber ball is fitted are stamped out in this machine. When heated to the temperature of boiling water gutta percha becomes soft and impressionable

The rubber ball is fitted into one of the gutta-percha shells and then placed in a heated mold. It is capped with a second shell and the other half of the mold. It comes out a ball

The mold that unites the various parts of a golf ball has small hemispherical protuberances on its inner surface. Thus, when the ball is removed, it is covered with depressions



A coat of paint is the last thing that a golf ball receives before going into service. The painting is done by hand, and care must be taken that it is put on evenly. If not the ball will follow a swerving course when it is played

Popular Science Monthly

Measuring One Five Hundred Millionth of an Inch

There is a machine that does this with perfect accuracy

By C. A. Briggs *and* Raymond F. Yates

THE sun Betelgeuse is about 354,000,000,000,000,000 miles distant from the earth. A distance of one two hundred millionth of an inch has just been measured. Our imagination is helpless when faced with such tremendous figures. In the one case, man's unit of measurement, the inch, is hopelessly large; in the other case its smallness makes it utterly insignificant. A millionth is the thousandth part of the thousandth part. A millionth of a mile would be less than one seven hundredth of an inch! With these staggering figures in mind, let us set out to see how a five hundred millionth of an inch is measured with perfect accuracy.

We must first understand what is meant by an alternating electric current. The current that lights our homes may have a "frequency" of 25, 60, or 133 "cycles." This simply means that the current travels first in one direction and then in the opposite direction 25, 60, or 133 times (cycles) a second. Such currents are called low-frequency currents. By the use of special apparatus, electric currents of small strength have been made to alternate ten million times a second.

Alternating currents of high frequency may be generated by that wonderful little Aladdin's lamp called the vacuum tube. It is unnecessary to explain its operation. We shall simply keep in mind the fact that with the aid of vacuum tubes we obtain electric currents of very high frequency.

What Is Electric Induction?

Let us imagine two electric circuits, each containing a vacuum tube. The vacuum tube in one circuit will be producing a current with a frequency of 100,000 cycles a second, while the tube in the other circuit will be creating a current with a frequency of 101,000 cycles a second. Now, when two electric circuits are brought together, the current in one has a tendency to "induce" itself in the other circuit. This is the phenomenon of "electric induction," and in our case the 100,000-cycle current in one circuit will induce itself in the circuit with the 101,000-cycle current.

What happens then? We shall see that the current superimposes itself upon the other current. But what effect does this have on the frequency of the current in the second circuit? We must not think that the frequency of the first current would be added to the frequency of the second current. Instead, we get what might be called a "beat note" in the circuit. This beat note will have a frequency that will be equivalent to the difference in the frequencies of the two currents. It will have a frequency equal to the difference between 100,000 and 101,000 cycles, or one thousand cycles.

The frequency of any electric current depends upon the values of inductance, capacity, and resistance of the circuit in which it is flowing.

Any changes, even the slightest, in these values will change the frequency of the electric current. Thus, if we increase the resistance (the opposition to current flow) of a circuit, the frequency of the current will be lowered. If we change the capacity, the frequency also changes. Now we are going to center our attention on capacity, since it is through a change in the capacity of the electric circuit before mentioned that the measurement of small distances is made possible.

First, what is electrical capacity? All we need to know is that a large part of the capacity of the circuit we are interested in is represented by two metal plates separated from each other by a non-conducting medium (in this case, air). Such an arrangement constitutes an electrostatic condenser, and an electrostatic condenser has a certain "capacity" to store electric energy. When the condenser becomes "charged" full, it discharges.

The capacity of a condenser depends largely upon the size of the metal plates and the distance between them. The larger a condenser, the longer it takes to become charged and discharged. Therefore it affects the frequency of the circuit of which it forms a part. Now, the circuit we are considering is extremely sensitive to a change in capacity, and if the plates of the condenser are moved a distance as small as one two hundred millionth of an inch, there will be a noticeable change in the frequency of the beat note. We see, then, that our measuring device is really an electrostatic condenser.

The Condenser in Action

The plates are in a frame, and one plate is provided with a measuring-tip. Pressure on this tip changes the distance between the plates, and this in turn changes the frequency of the circuit in direct proportion. The change in frequency is recorded in numbers on a frequency meter, and from this is computed the distance measured.

The tremendous sensitivity of this device brings us into a new world. When a penny is laid on a table-top, this device is able to measure the bend in the wood due to the weight of the coin! A piece of steel is like a quivering mass of jelly. We can watch it expand from the heat of the body of a fly walking on it. Such a measuring system could never be applied in a practical way. However, the sensitivity can be regulated, and before long we may have a practical measuring system that will be accurate to a five hundred thousandth of an inch - which is plenty!

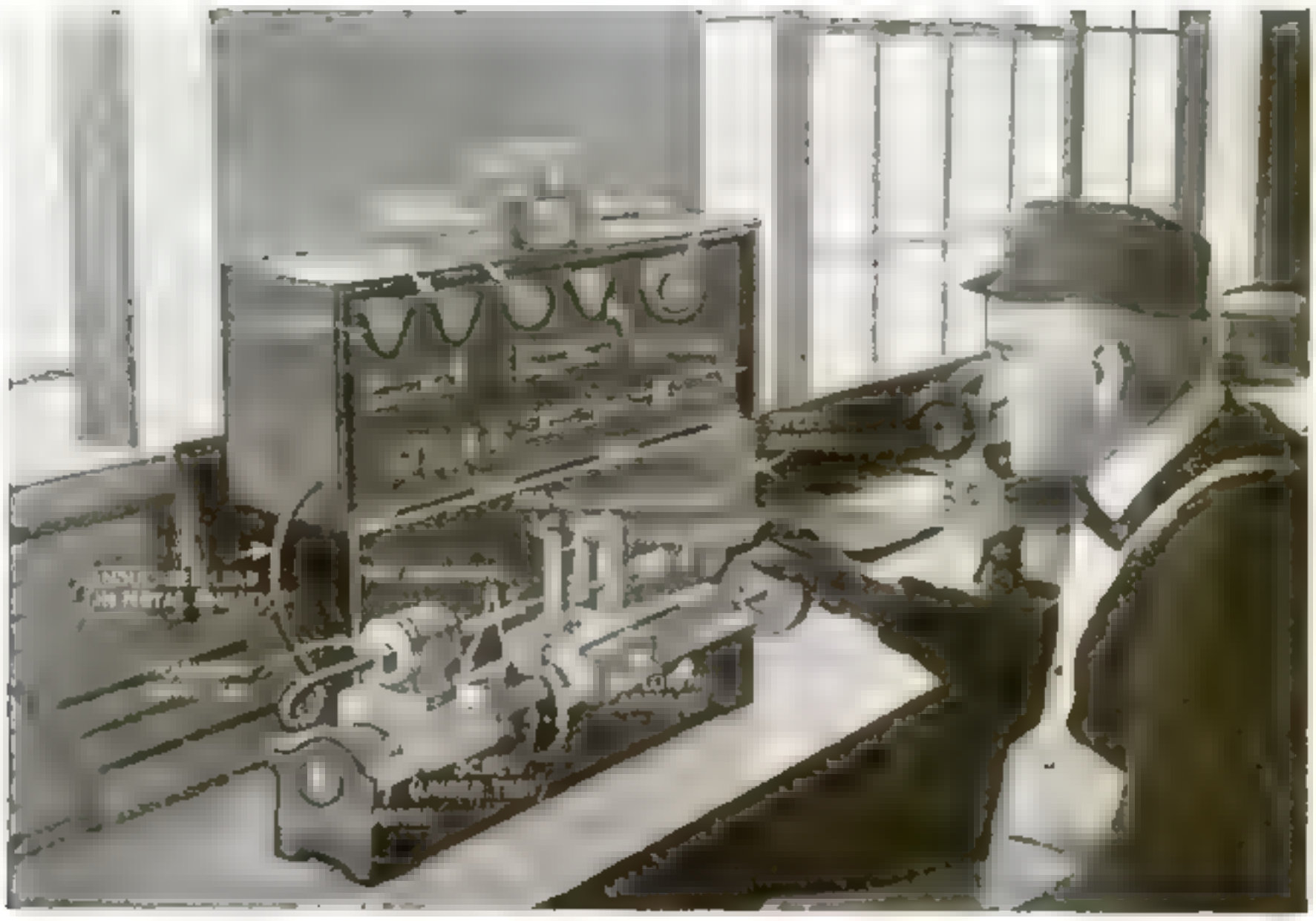
The present arrangement is so sensitive that work has to be carried on at night to prevent interference from the city traffic. The measuring condenser may also be employed as a very sensitive indicator of sound. The sound waves of the air impinging against the movable condenser plate will cause disturbances in the circuit and if a receiver is used in place of the frequency meter, sounds of very small magnitudes can be detected over tremendous distances.

How a Fly Bends a Half-Inch Steel Rod

IMAGINE a steel rod one half inch in diameter and twelve inches long. Imagine this rod held horizontally with one of its ends in a vise and a fly on the opposite end.

Would you believe that the weight of the fly would bend the big steel rod? It does, and with the electrical measuring system here described it is possible to record the distance!

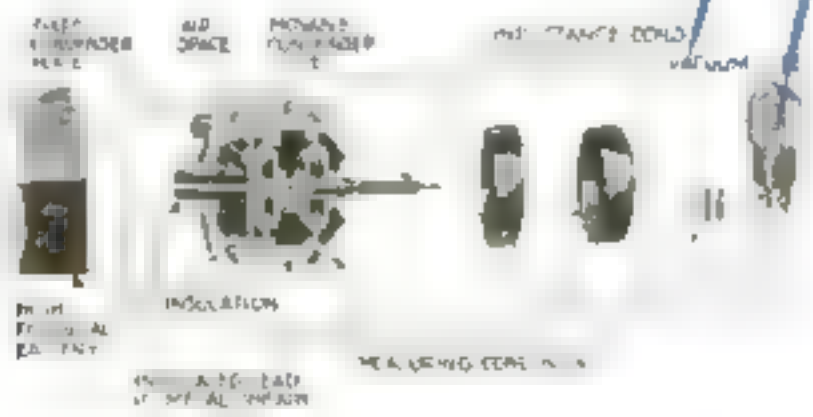
This work in "ultrameasurement" has been done by Prof. R. Whiddington, an English scientist. With this system a distance as small as one five hundred millionth of an inch may be measured.



Measuring a Millionth of an Inch in the Machine-Shop

Above is a practical electrical measuring device for shop use that is sensitive to one one millionth of an inch. It is so designed that it can be manipulated by a workman without any knowledge of electrical or physical laws.

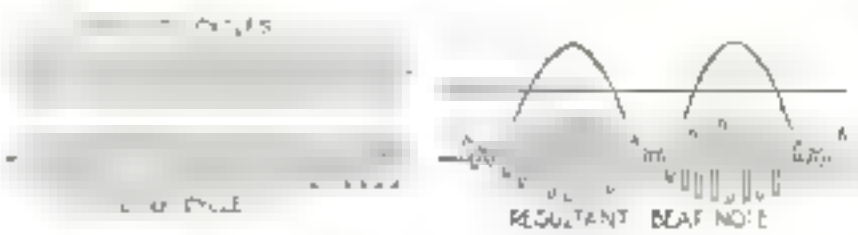
A lever system with a ratio of 100 to 1 is used in connection with the measuring condenser which is shown mounted at the end of the steel bed. A depression of the plates in the measuring condenser causes a change in the frequency of the circuit, which is indicated by the frequency meter on the top of the cabinet.



Here is the circuit in which the "beat notes" are produced and amplified. The frequency meter, which measures the frequency of the beat note, is included in this circuit. The change in the frequency of this note is caused by the variation in the distance between the plates of the condenser connected in the circuit below.

A sectional view of the measuring condenser is shown here. One plate is equipped with a projection that comes in contact with the article to be measured. As the plates approach each other, the frequency of the circuit will be changed. Here the condenser is shown connected with the rest of the apparatus.

The diagram below shows how the current in one circuit is superimposed upon the current in the other circuit, and at the side is shown the resultant beat note that is produced by this action. The frequency of this beat note is a measurement of the depression of the plate in the measuring condenser.



Radio Sets This Timepiece

MANY people are not aware that the big government radio station at Arlington, Virginia, sends out the correct time every day This is done by connecting the master clock in the United States Time Observatory with the radio-transmitting apparatus in the station several miles away

Every time the clock ticks, it closes an electric circuit in the radio station, and an electric impulse is sent forth

T S Cisne has developed a clock that is controlled by the radio impulses sent out at Washington It is corrected every day by these mysterious impulses

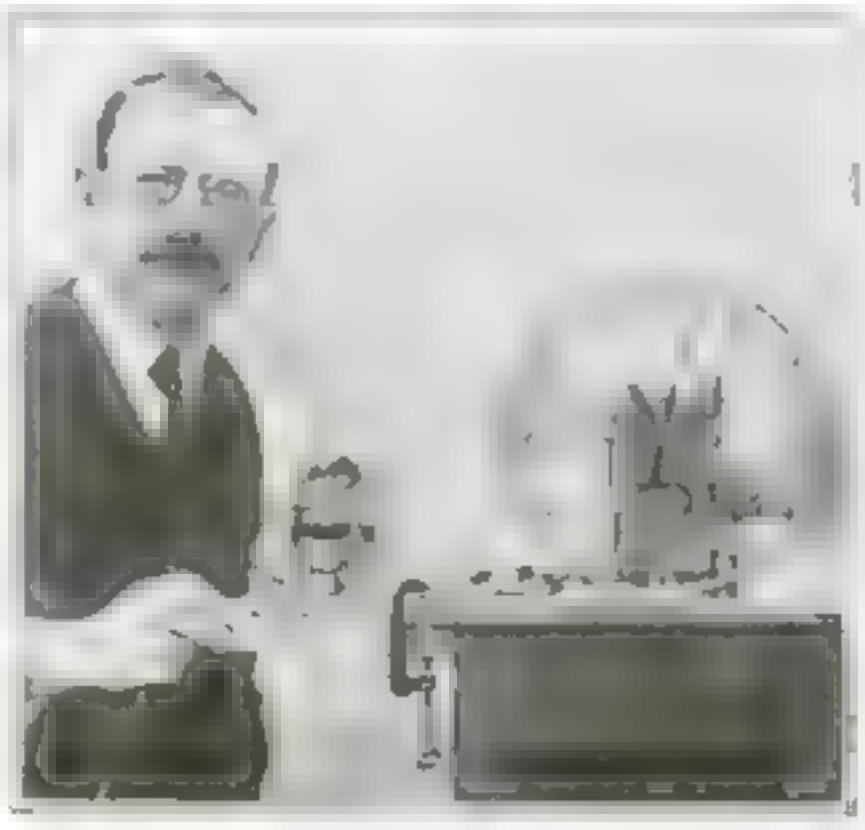
It can be used as a master clock, so that it will control any number of separate timekeepers.

Clock Makes Memory Training Unnecessary

PATENTED by an Iowa man is a "reminder clock" which, if it comes into general use, may make memory training unnecessary

The face of the clock is like that of any ordinary clock, but the lower part has a scale It is eight inches long and is marked from 1 to 90, each number representing a minute A movable thumb lever is on the dial. Suppose you want to boil an egg Set this lever opposite 3 just after dropping the egg in the boiling water When three minutes is up, an alarm bell rings.

In photographic studios, where timing is so important in developing, this clock is invaluable



It Is a Seat and a Parachute

SHOWN above is a new airplane safety parachute that serves as a seat for the aviator when it is not in use. Strapped to his back in the usual manner, it is arranged so as to hang out of his way When he takes his seat in the airplane, the folded parachute becomes a cushion

Should any accident occur, the flier has only to step out of the plane pull the ring that opens the parachute, and descend in safety No further adjustments are required. That the parachute is a very present help in time of need, the airman is willing to testify; it is more valuable to him than the lifebelt is to the sailor

Flowers in Burnt-Out Electric Bulbs

TAKE any burnt-out lamp and a pair of pliers. Hold the metal cap in a flame, and slightly turn the metal screw cap with the pliers until it comes off Then break the wire

File through and break off the crown holding the glass rod with its filaments. Just below the ruby that connects the rod with the base is a heavy ring of glass. Carefully round off all corners of the heavy ring in a flame

Pieces of cardboard are used to make the stand [illegible]

Below Is a Man Pushing 100,000 Pounds

HE is rolling a weight of more than one hundred thousand pounds along the track but he would not be able to do it if the axles of the flat-car were not provided with a new type of roller bearing

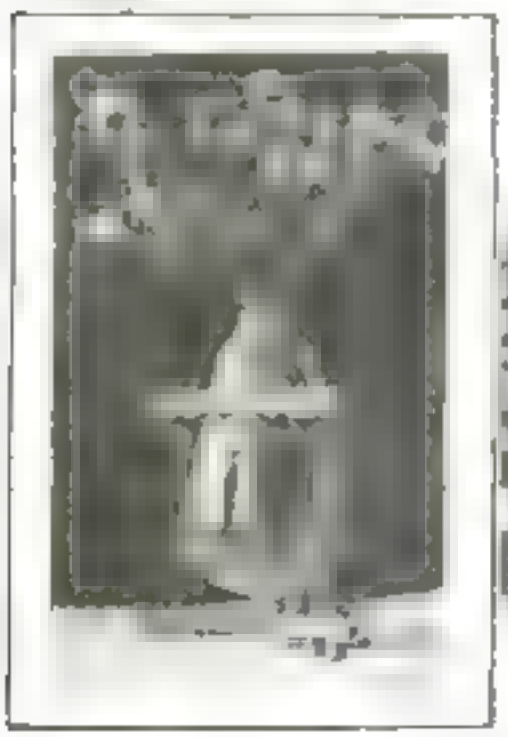
The inventor of this new device claims that the saving in power required to move the car runs as high as 90 per cent It would be hard to believe this unless one could see one man rolling such a tremendous weight over the track Under ordinary circumstances it would take at least sixteen men to move a car loaded with the same weight

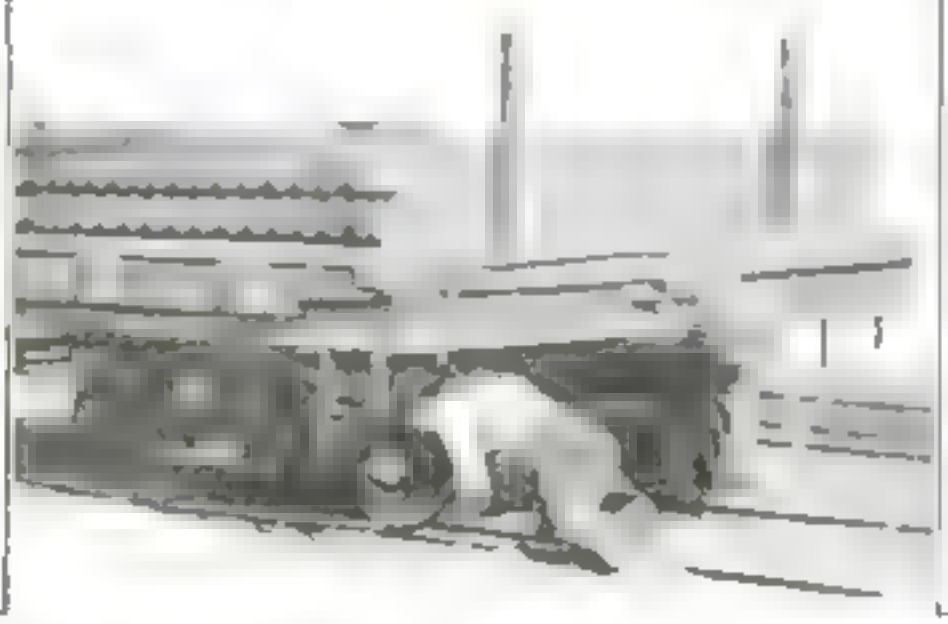
The view illustrates the great difference between sliding and rolling friction

When Not Used, This Coat-Peg Hugs the Wall

A NEAT little peg is fastened to the wall with three small screws It is made in several metals, and is spring controlled, hugging the wall until in use, and then it will hold a hat and coat with ease. As soon as the garments are removed, the peg springs back to its original position, which is a distinct advantage where the hall is narrow or where space must be conserved

Hung on a door, the peg might serve very well as a knocker; and screwed to a desk, wouldn't it make a good paperweight?





Dictating Letters Through a Horn

POSSIBLY you are wondering what is the reason for the large horn on the desk of the business man shown above. It connects him vocally with his stenographer, whose desk is in the next room. When he wishes to dictate a letter he talks into the horn, and his voice rings out of a similar horn on the stenographer's desk.

The end of each horn is covered with a parchment drum that is held firmly in place by a steel band. A taut wire is stretched from drum to drum and across it, the vibrations caused by the voice are carried. If the wire is not taut, the device does not function properly.

This contrivance did away with a great deal of running back and forth.

Signals from the License-Plate

YET another scheme for making automobiling less dangerous. Cut the numbers out of the rear license-plate and place a piece of transparent paper in back of it. Connect up a red and a green light behind the plate in such a way that the red light will flash when you step on the clutch or brake, and the green light will flash when you remove your feet.

On a dark night this will be very useful

They Climb Over Live Wires with This Ladder

WEIGHING only thirty-three pounds, and with the advantage of folding into a compact load for transportation, this safety ladder for linemen is one of the newest electrical workmen's accessories.

The ladder is braced out from the pole by two supports attached to crossbars set in the back of the ladder. There are three of such bars at the top, middle, and bottom of the ladder, and the supports may be set on any two bars desired. A treated rope is used as a diagonal brace, its length being adjustable relatively to the supports. The construction provides ample protection on a 110,000-volt line.

Ribbon Woven by Hand on a Tiny Loom

HERE is a small model of the usual large hand loom. It is used for weaving small things—ribbon, for instance. And it has been found that ribbon made in this fashion lasts much longer than ordinary machine-made ribbon.

Only a few strands are used, and the silk is brought down from them to the weaving platform. Here it is interlaced with strands from cross shuttles and then "packed."

The packing consists of forcing the threads together so that the resulting ribbon will be smooth and straight.

It is said that ribbon made in this way will last for years. The same is true of lace that is hand made.

Life-Boats Carry Wireless

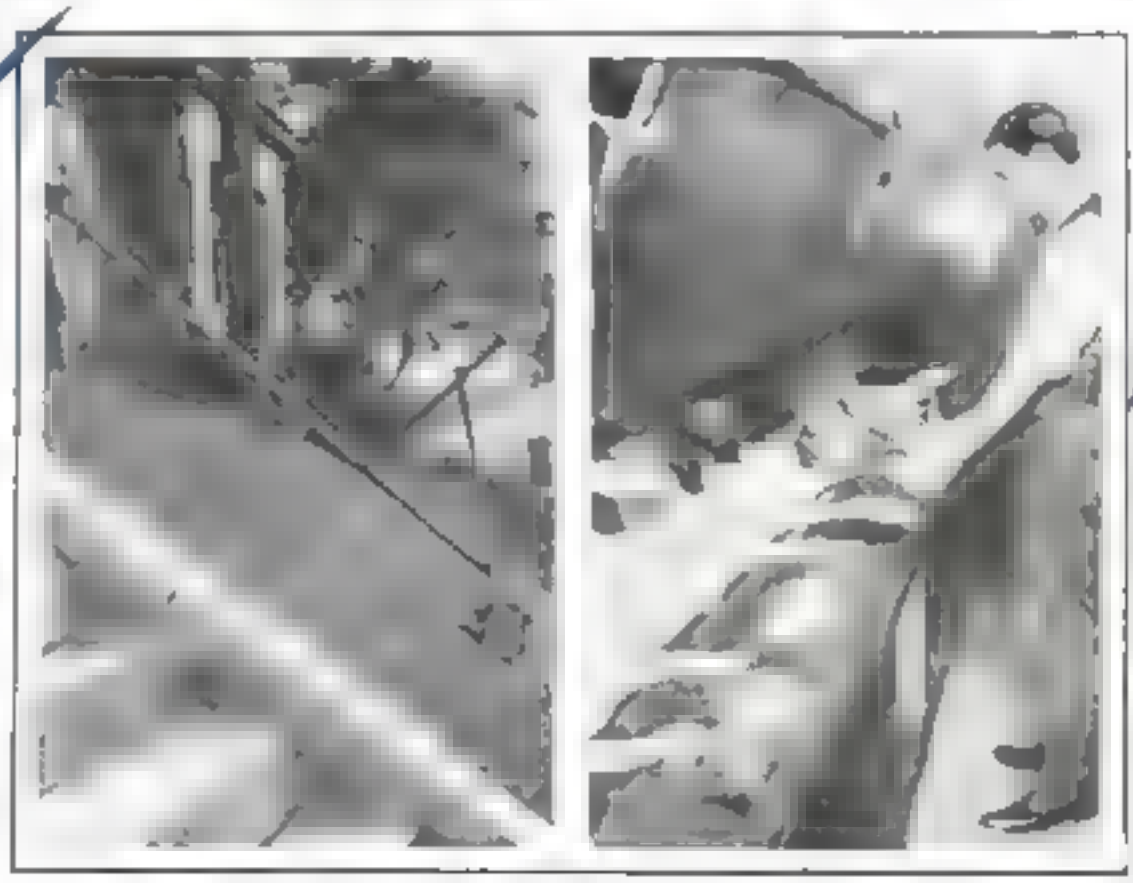
ON the *Olympic*, which sails between Southampton and New York, two special life-boats have been added to the equipment. They are twenty-eight feet in length and will accommodate thirty-six people apiece.

Both boats are motor-driven and are fitted with a wireless outfit. Under ordinary conditions they will be able to send and receive messages within fifty miles.

The Lawn-Mower with the Long-Reaching Arm

A RESIDENT of St. Joseph, Missouri, Theodore J. Kalhauner, had two twelve-foot-high terraces in front of his house. Every time he trimmed them with the mower, risking his limbs if not his life, he became convinced that something ought to be done about it.

As you see, Mr. Kalhauner did something. The long handle permits him to stand at the top of the terrace while mowing it, and the adjustable shorter section, with the slot at top for the handle of the mower, allows the mower sufficient leeway to prevent its jamming if suddenly brought up at an awkward angle. This attachment can be used on any type of hand lawn-mower.



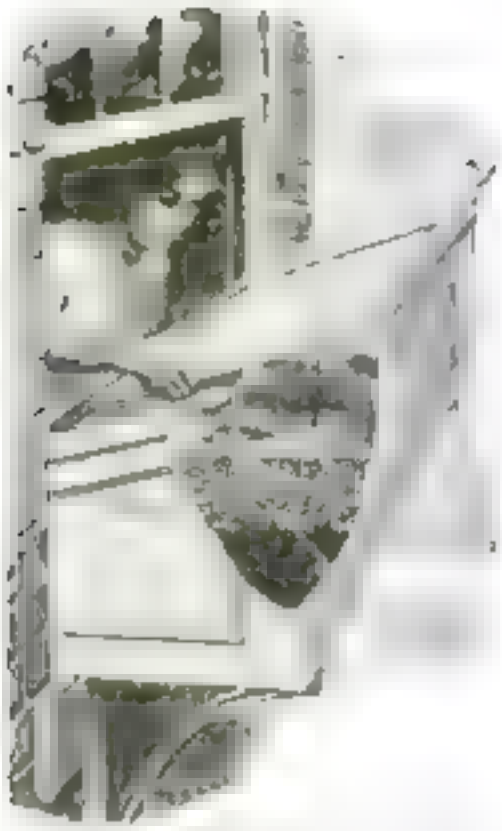
Bootblack and Customer Are Separated by a Partition

THE bootblack in the picture on the left polishes shoes without ever seeing the face of his customer. The customer sits on one side of the partition while the bootblack works on the other side. It makes a refreshing change from the usual conversation.

The bottom of the partition is cut away so the customer may place his feet on the foot-rests. The customer does not have to climb up to his seat, knocking over bottles and cans on his way.

The little doors in the partition are used to make change and to pay the bootblack.

The partition certainly ought to be useful to the bootblack when he smears up a customer's clean white socks.



Plants Will Flourish Here

IF you would bring the small cuttings of geraniums, fuchsias, and roses to maturity, heed the advice of the United States Department of Agriculture

First build a window-box and cover it with glass. In the bottom of this box place some broken bits of pottery and stones. On the top of these place some clean sand free from clay or decaying organic matter. Place the cuttings in this, and give them plenty of sunshine and water. "Plenty of water" does not mean drowning them. As the roots start to branch out, the glass cover should be partly removed for ventilation.

Measuring the Heat of Fruit

A RESPIRATION chamber for bees? What is that you ask. It is a study energy transformation of fruit and [illegible] chamber is provided with [illegible] and the quantity [illegible] arrangement has made possible the [illegible] of considerable data [illegible]

The Blind May Now Enjoy Football

PERSONS who have lost their sight usually develop the hearing faculty to an unusual degree. This enables them to get a great deal out of life in spite of their apparent misfortune. A blind man probably gets more enjoyment from a concert than a seeing man possibly can. But a blind man at a football game is at a disadvantage. He can hear the crowd yell, but he does not know what it is all about.

Joseph Gibbs, a Scotchman, has invented an ingenious apparatus that will enable a blind football fan to follow the development of the game with surprising accuracy. Little wooden men are used to mark the various positions of the players. If a person with sight keeps the blind person informed as to the plays, the latter may obtain a very good idea of the progress of the match by arranging the men on his board accordingly

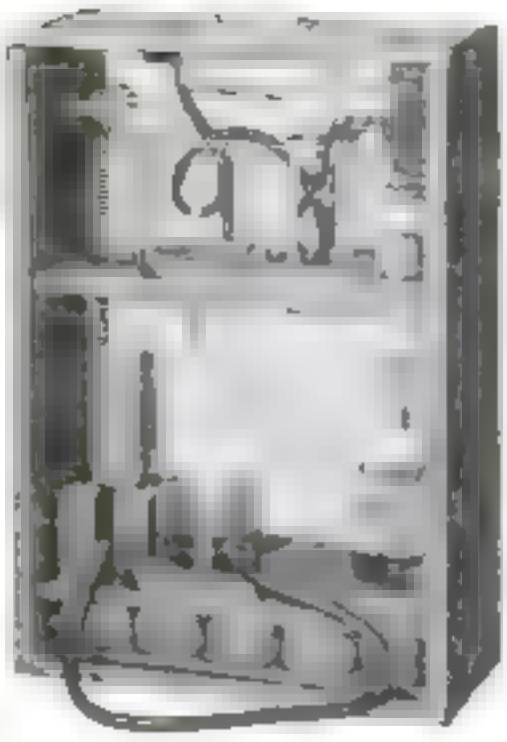
Artificial Pearls Made in America

NEARLY every woman has her string of pearls—artificial ones. They may cost fifty cents or fifty dollars. How are they made? By coating the inner surface of thin glass beads with a paste made from fish-scales. Formerly they were manufactured chiefly in France. The fish-scales were bought from Russian fishermen. But during the war the United States Bureau of Fisheries developed a substitute for the Russian fish-scales.

The scales of shad and sea herring have the delicate color of Oriental pearls. This scale coating was removed from the body of the scales as it [illegible] and is known as pearl essence. The herring and shad found in Chesapeake Bay gave the best

The pearl essence is a pastelike substance that will adhere to any surface. When it is smeared on the inside of thin glass beads it will harden [illegible] cement

How are real pearls formed? The present belief is that a small parasite bores its way through the shell of an oyster. The parasite is killed by the oyster, which immediately proceeds to cover the parasite. This covering process continues until a pearl is gradually formed. Jewelers make a distinction between artificial and imitation pearls—the former are more expensive.



How Much Zinc Is There?

HOW to test the galvanized surface of iron pipes is a new discovery. This new test will determine the weight of zinc on a unit area of galvanized surface regardless of convolutions or corrugations. Dr. Allerton Cushman has found that by collecting the hydrogen gas from any known area of surface, the weight may be determined.

A small container filled with hydrochloric acid is cemented to the pipe to be tested. When this acid comes in contact with zinc, hydrogen is evolved and the gas passing off is collected and measured. It is then easy to find the quantity of zinc on the surface

Goat Decoy Traps Leopard

BELOW is shown an Indian leopard-trap. A live goat is confined in the trap, protected by strong bars.

The trapdoor is raised [illegible] from the ground by a lever [illegible] above, while the lower end of the lever is attached to a rod [illegible] raised off the ground inside the trap. The decoy bleats and the leopard, in attempting to get at its prey, treads on the lever and the heavy door falls into position. His next public appearance is as a captive.

Courtesy of the U. S. Bureau of Fisheries

Salmon Eggs Hatched by the Million

THE United States Department of Fisheries is busy raising fish eggs, so that we may continue to enjoy eating fish.

In the great fish-hatcheries maintained by the government [illegible] are protected every year. When they reach the proper growth they are placed in the water to fend for a living themselves.

Above you see a tray of salmon eggs that have been under expert care for several weeks. It is only one of many thousand such trays.

A One-Man Road-Grader

ONCE two teams of horses and at least two men used to be required to level and grade roads. Now we have the one-man machine, which does the job in half the time and never gets tired. Like all modern devices of this nature, it is, of course, driven by gasoline.

The single operator manipulates all the levers that control the cutting blades and also takes care of the engine. All the controls are placed at his elbow.

If you live in a community where it is the custom for each man to contribute his share of labor toward keeping the roads in condition, it will pay the men of the neighborhood to get together and purchase a one-man road-grader and [illegible] the time and labor ordinarily necessary for this task.

This Motor-Driven Grinder Cleans Castings

ABOVE is a new departure in hand-grinding outfits. Although nothing that resembles an electric motor is seen, there is one present. The motor is so constructed that the grinding element, which is made in the form of a ring, is attached to the [illegible] part of the motor.

The motor is very strong, a shell one of the induction type and capable of great speed. It is held in the hands and the grinding-wheel is allowed to revolve in contact with the rough castings that have to be cleaned.

Let Concrete Harden Thoroughly

IF concrete is not given sufficient time in which to harden before it is used, it will wear out rapidly. But what is sufficient time? An expert tells us that ten days are barely enough. If this is extended to twenty days, the concrete will give 40 per cent better service.

During the hardening period the surface should be kept warm and moist. A cover of sand that is sprinkled daily will serve the purpose.

Concrete floors over which heavy hauling and trucking is to be done will become rutted and cracked if put to use before being thoroughly hardened.

Coke Will Deodorize Your Icebox

SHOULD you put milk and onions in the same refrigerator, the milk will soon absorb the onion taste and become very disagreeable. Butter is another substance that is quick to absorb smells and tastes. And, of course, one can't have several refrigerators. What then?

Place a small box of coke or charcoal in the corner of the refrigerator. It will act as a deodorizer, absorbing all kinds of smells, and will keep the food wholesome. Especially in warm weather is this precaution necessary.

The coke or charcoal should be changed every three weeks, for in that time it will have become thoroughly saturated.

Carrying a Gun by a Trousers Button

HERE is a gun-carrier that will minimize the chances of accidents, besides allowing the sportsman the use of both hands.

It is in the form of a single suspender, fastened to a trousers button at the back, left side, from where it is drawn over the right shoulder. As you see, the suspender is composed of a strap and two springs, a larger one in front and a smaller at the back.

These springs afford the resiliency needed to prevent the gun's hanging as a dead weight from the shoulder. The suspender holds the gun by the lock; thus the butt rests under the armpit and the barrel is pointed downward—the only safe position for a gun not in use.

The Accommodating Seat with a Spring

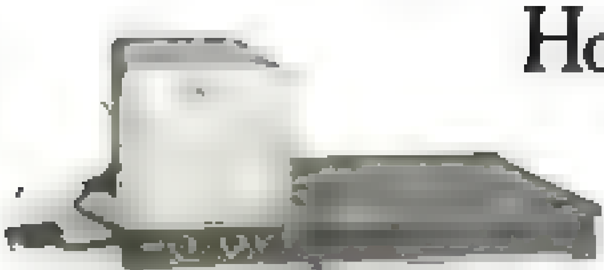
WHILE this stool was built primarily for dentists, it is clear that the [illegible], bookkeeper, and others will find it useful.

One of the chief features of the stool is a heavy steel spring, with a ratchet for the purpose of adjusting the height. This ratchet is controlled by a sprung handle that also serves for carrying the stool from place to place.

Some one remarked that the stool seemed almost to think, so responsive was it to every least motion of the person who occupied it. That responsiveness is due to the heavy spring that rises from the base, and which, while giving ample support to the sitter, adjusts itself instantly to any position desired.

Housekeeping Made Easy

Look this page over: you may find just what you need



Ovens are [illegible] and require [illegible] able heating [illegible] they are ready [illegible] Now, however, [illegible] is a small electric [illegible] [illegible] it sits over an electric heater

Here is a substitute for the electric toaster. It is an alcohol heater. A [illegible] alcohol lamp fits [illegible] stand and when it is lighted gives out sufficient heat to toast bread

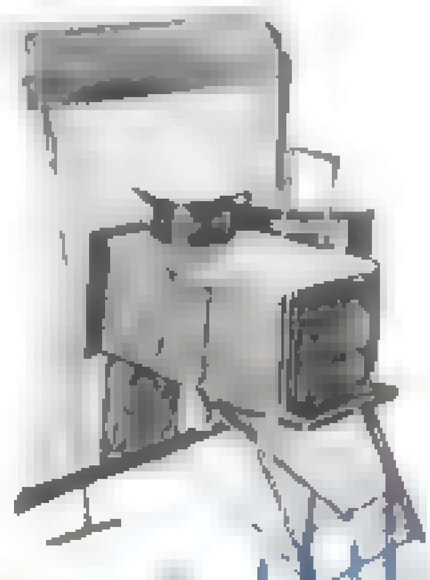
[illegible]

© Keystone View Company

© Keystone View Company

The ravaging effects of dish water on hands led to the invention of the plate holder shown above. Pincers grasp the plate as you dip the plate in the water, holding it by the handle

If you squeeze a tube of tooth-paste by means of a thumb-screw at the right, you will get more out of it. The end of the tube is thrust through a bar that the thumb-screw turns



The [illegible] really [illegible] those impressive bindings is a phonograph. But why be so secretive about a phonograph?

This small [illegible] in coal stove and [illegible] summer. A [illegible] large stove [illegible] heat the [illegible]

Instead of knotting the ends of the clothes-line [illegible] metal holder shown above. [illegible] of a slip-catch it holds the line steady

If you fry doughnuts in very hot fat and also [illegible] cage, your [illegible] will be crisp but not at all greasy

This mustard jar has a spout from which the mustard oozes [illegible] you press a knob at the top whenever you want the mustard to flow

Keeping Up with the March of Science

Facts for the man who wants to know

Square Coins for Australia

THE square coin is coming into use in Australia. Before long all of the round Australian halfpennies will be called in.

There are two good reasons for minting square coins. They pack better when they are boxed, and very little metal is wasted when they are cut out of the sheet. In the case of round coins, considerable metal is left that must be smelted over again.

A New Paper-Filling Clay

A NEW clay for paper filling has been found by the research workers of the Forest Products laboratory. It is very useful in giving a printing surface to paper.

In the past, all of the clay used in this country for "loading" paper was imported. The American clay was found in the West, and it has been found an excellent substitute for soap.

The workers at the Forest Products laboratory found that it produced a beautiful grade of paper when it was mixed with English china clay.

The mixture produces a more velvety surface than where the English clay alone is used.

Blood Rains on Monte Carlo

THE people of Monte Carlo were terrified recently when the rain brought down what they believed to be blood. Superstitious persons thought that something terrible was about to happen.

There is a scientific explanation for nearly every unusual thing in nature. Scientists were not long in giving a reason for this phenomenon. They pointed out that it was due to the red sand of the Sahara desert.

The clouds had become saturated with the sand and it was carried to Monte Carlo before the clouds precipitated their moisture.

What Colors Mosquitoes Like

IN the world-wide battle with mosquitoes very little attention is paid to the question of color. However, experiments have proved that the mosquito has a marked fondness for certain colors, and an almost equal aversion to others. For instance, a person wearing white shoes and stockings will be bitten on the ankles once while a person wearing black shoes and stockings (other conditions being equal, of course) will be bitten twenty-five times. If a black and yellow dog are together, it will be noticed that, while the black dog will suffer torments from the attacks of mosquitoes, the yellow animal will be troubled but little.

The experiments that determined accurately which colors are most liked by mosquitoes were conducted by an English scientist, under the auspices of the Liverpool School of Tropical Medicine, and covered a period of seventeen days. Boxes, lined with rough cloth of various colors, were so arranged that newly bred mosquitoes, upon emerging from the water, could enter whichever box most attracted them, care being exercised to see that no box was in any way more desirable than another by reason of greater light or shadow.

At the end of the test period, 103 mosquitoes had entered the navy-blue box, 90 the dark-red box, 81 the reddish-brown, 59 the scarlet box, and there were 49 in the black box. There was then a sharp drop to 31 in the slate-gray box and 24 in the olive-green. Violet, leaf-green, and dull blue attracted respectively 18, 17, and 14. Pearl-gray drew but 9, pale-green 4, light-blue 3, ochre and white 2 each, orange 1, and pale yellow or khaki none at all.

Houses 7000 Years Old

PEOPLE lived in Switzerland more than seven thousand years ago. We know this because a drought in Greng, near the Lake of Morat, revealed the remains of a prehistoric village. The level of the lake went down to such an extent that the bottom was exposed in many places.

The ancient dwellings were built on piles driven deep into the mud. The huts on the piles were made of wood and clay. Straw, reeds, and rushes formed the thatched roofs. Numerous relics made of stone, copper, bronze, and iron have been dug up from the mud.

Bones of all the common animals have also been found. It would appear that the people who occupied these humble dwellings were civilized.

Aluminum as Strong as Steel

THREE small thin plates of steel will be balanced by nine similar squares of sheet duralumin, an alloy of aluminum that can now be made as strong as steel. Experiments conducted in the laboratory of an airplane company at Keyport, New Jersey, have succeeded in producing a quality of duralumin that is non-corrosive in salt water. It is of great value in the construction of flying-boats.

How was the "light-weight" aluminum compound converted into a giant of strength equal to the "heavy-weight" champion, steel? Mainly by the method of heat-treatment, annealing and tempering at certain temperatures and for certain periods, was the result obtained. Tests were conducted at intervals after the heat-treatment to show the effect of aging. It was found that, 120 hours following the heat-treatment, the duralumin stood a tensile test of 59 700 pounds to the square inch with a hardness of 25.2 per cent.

Artificial Leg Affects Watch

GOOD watches lose in accuracy by exposure to a magnetic field. A war veteran working in a watch factory found it difficult to keep his watch right.

Knowing something of magnetism, it occurred to him that the steel in his artificial leg might be magnetized. He experimented and found this to be the case.

He went to an electric-light company and had his leg demagnetized. After this treatment his watch kept perfect time.

Charting River-Bottoms

CHARTING the bottoms of rivers and creeks is just as important as charting their courses and shore-lines. A device is used that will draw the profile of a river-bed.

A few years ago river-beds were charted by sounding. The new device has few parts and it is absolutely fool-proof in its operation. The line is drawn by placing a pencil at the end of a long rod. The opposite end of the rod is provided with a wheel that rolls over the bottom of the river.

The variation in the bottom of the river is traced accurately, and by noting the depth at chosen intervals of time, the bottom of the stream may be charted.

Modernness of the Ancients

WE have only to turn back the pages of history to discover that the ancients had some very modern notions.

Mr E. W. Hulme pointed out before the Newcomen Society, recently organized in England to study the history of engineering and technology, that in the great Palace of the Two Axes in Crete there was a system of water-carried sewage and terra cotta socketed drain-pipes that could not be paralleled in Europe prior to the eighteenth century.

Identified by Veins

SINCE the finger-print method of identification has come into use, several other methods have been suggested. An Italian scientist has suggested the use of the veins in the hand. He has found that the veins are different in different persons.

The veins are easily seen when viewed with a source of light that has no red rays. The mercury-vapor arc light is suitable.

The Strongest Wood

WHAT is the strongest wood? Some would say oak, but African teak is much stronger.

Jarrah and greenheart wood are heavy and strong, and oak is found to compare more favorably with them.

Willow, poplar, and spruce are first

among the light woods that find wide use Balsa wood is the lightest wood that is known.

A cubic foot of African teak weighs eighty pounds, while a cubic foot of willow weighs but thirteen pounds. When subjected to a strain test, African teak did not break until 855 pounds was reached. A piece of ash of the same size broke at 690 pounds

Coffee Painted to Order

BRAZILIAN coffee-dealers will paint coffee any color desired There is black coffee, brown coffee, yellow coffee, blue coffee, and green coffee

The health authorities of some countries will not permit the entrance of painted coffee. Its entrance is not allowed in the United States. However, many of the South American countries prefer colored coffee, and certain states in South Africa also like to use coffee colored to suit their taste

The coloring matter is applied in big revolving cylinders provided with paddles Each cylinder holds about six bags of coffee. Vegetable coloring matter is used

Truth about Sea-Serpents

SAILORS often bring in lurid stories about the great sea-serpents they have seen in their travels. It is safe to assume that many of these stories are manufactured. It would not be well to say that all the stories are untrue

An instance of a manufactured story is the one about the octopus caught by the sailors of the steamship *Caronia*, last April. The story had it that ten sailors attempted to overcome the monster, which put out a tentacle for every sailor. All the newspapers printed this story, which had come in by wireless. When the ship reached port, it was ascertained that the "octopus" would easily fit in a matchbox!

Professor J A. Thomson, lecturing before the Royal Institution in London, described the giant fish that sailors have dubbed the "sea-serpent." It is known as the oar- or ribbon-fish, since it is flat like an oar

The ribbon-fish often reaches a length of twenty feet. When it is attacked by an enemy, it shoots several feet out of the water. Its great length gives it the appearance of a serpent

Dirty Bulbs Are Dangerous

ELECTRIC lights will not reach a dangerous temperature if the glass bulb is kept clean

A clean bulb allows the heat to radiate into the air and thus keeps the temperature normal

The accumulation of dust and grease on the outside of the bulb tends to insulate the hot filament and prevent the escape of heat. This causes the temperature to reach a dangerous degree, since this dust is often brought to the ignition point.

The moral is: Keep the electric lights in your home well dusted

Sparks Cause Explosions

A RECENT premature explosion in a quarry, resulting in the death of nine men and the injury of several others, was directly traceable to a spark from a steam-shovel working under the face directly in front of the hole being loaded. This accident and similar accidents on record in the Bureau of Mines indicate the necessity for pointing out the dangers in quarries of explosives from sparks emitted from steam-shovels and locomotives, and making recommendations for greater safety

In the Canal Zone, a steam-shovel uncovered a misfired charge of dynamite While the dynamite was being picked up, the steam-shovel continued working near by. A spark from the shovel set fire to some loose dynamite spilled on the ground from the broken cartridges. This fire was transmitted to a hole that was being loaded close by, and caused a premature explosion. One man was injured

World's Longest Penstock

FULLY, Switzerland, has a hydroelectric plant that receives its supply of water from an Alpine lake seven thousand feet above sea-level. The plant is two thousand feet above sea-level, and the water drops five thousand feet before it finally reaches the wheels in the power-house

A long steel pipe, or penstock, carries the water from the upper level to the water wheels in the power plant, where twelve thousand horsepower is generated. When the water reaches the end of its long journey, it is traveling at a speed of 590 feet a second.

This is the longest penstock in use in the world

Uses of the Coconut-Tree

THE inhabitants of the Dutch West Indies depend almost entirely upon the coconut palm for the necessities of life They make use of every part of the tree, from the roots to the leaves

Roots are used in the preparation of medicine, and the hard wood is used in the construction of homes. The sweet sap of the tree is made into sugar and the big leaves are used to make baskets. The stiff ribs of the leaves are made into brooms, and the undeveloped nuts make a delicious dish when properly prepared. The nuts are used for medicine, when partly ripe, and the milk makes a good tonic for certain ills.

The husks of the nuts are shredded and made into rope. The hard shells make good cups and fuel, and the meat of the nut is an excellent foodstuff

Traffic Laws for the Sky

NEW YORK city has already set down rules for traffic in the sky "Drive to the right" is one of them. Aviators must also keep two thousand feet above the city, except when landing at places especially provided for that purpose

Nothing may be dropped from an airplane, and stunting is absolutely forbidden. In a case of forced landing, it must seek an open space where it will not endanger life or property. Lighter-than-air machines have the right of way over heavier-than-air machines

Violation of any of these rules makes the aviator liable to a fine of fifty dollars or a jail sentence of one year. Of course if there are air laws that can be violated, there must be an air police force to see that the laws are obeyed.

Why Not Perfume Your Food?

PERFUMED cookery—that is the latest novelty in the preparation of food It has been tried in Paris. Chicken with lily-of-the-valley sauce and veal cutlets with old rose!

Jules Mainstavé, the inventor of the new perfumed dishes, claims that the high purity of manufactured perfumes makes them perfectly safe to use for this purpose.

But how appetizing do you think the odor would be?

Would it appeal to a hungry man as does the aroma of roast beef or broiled steak?

For poets, musicians, and actors, probably yes, but for hungry men—no.

Wire Mesh for Roads

THE British army in Egypt has used chicken-wire in the construction of roads.

Loose sand was smoothed and leveled and then covered with chicken-wire, which was firmly pegged down.

The passage of troops or motor transports seemed to affect the road very little, while the passage of animal-drawn vehicles damaged the improvised road badly However, it was possible to make repairs quickly and the road was easily kept in good condition

Of course this wire-mesh road was purely a temporary expedient for the military The old Romans still hold the palm as the champion road-makers of the world. Many a foundation of the roads they made is still in use in Europe, the surface alone being modern.

How Copper Is Hardened

MANY inventors have labored incessantly trying to harden copper Their research work has been in vain The hardening and tempering of copper was a process that was believed by many to have been a lost art—presumably lost by the Egyptians

Copper is hardened to-day, and there is absolutely nothing mysterious about the process.

Mechanical working will produce hard copper. Hard-drawn copper is available as well as hard-drawn copper tubing The process of drawing this cold copper through a die hardens it considerably

When copper is alloyed with other metals, it is also hardened and great quantities are used in the workaday world.

Do It with Machinery

Some of the labor-saving appliances pictured below may help you in your work

This is both a screwdriver and a hammer. As a hammer it is useful for small work, and as a screwdriver all that can be desired. It is of steel

The man is using pliers that have ground grips for working with round objects. Ordinary pliers are unsuitable for round pieces

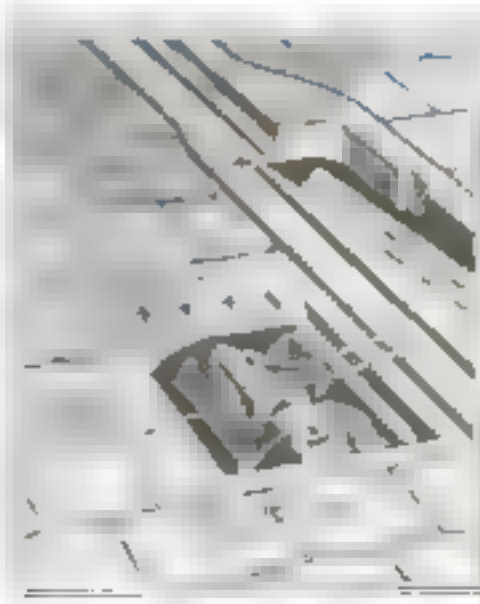
When this triangular "drill" is placed over a ... it is able to bore square holes in practically any wood. The body is triangular in shape and it cuts fast and accurately

A tool-holder without a set screw. ... of tool steel ... holds firmly in place at the top of the tool

Here is a ... It is connected with a ... of two ... After passing through the spiral members they meet in the ... chamber

Above is shown a floating tool holder. It holds a reamer in the lathe. When a hole is reamed out the reamer must follow the hole. This holder causes the reamer to do this

Combination speed indicator and stop watch. The ordinary speed indicator or "revolution counter" must be used with a watch. An enterprising manufacturer has combined the two



When a ... the ... by ... This ... is best ... either ... or straight with a ... and a can

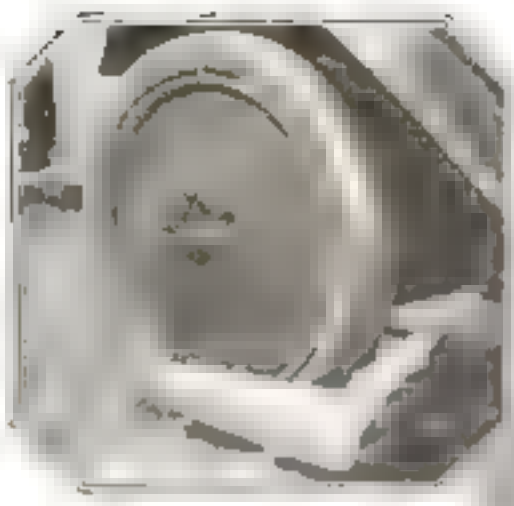
Here is a ... the ... and the ... manipulates only the lever

Should a link in a chain break, a new one can be inserted ... than it takes to tell. It is a very practical "missing link"

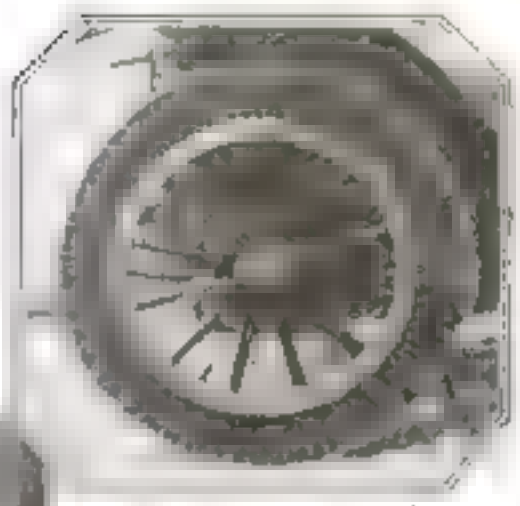
Mud-Guards to Protect the Man on Foot

Inventions submitted in a French contest

In muddy weather a metal disk, with brushes along the edge, is attached to the hub of each wheel. Thus the mud is caught in the brush



The guard, in this case, is made of rubber If you have any doubts about its ability to prevent the mud from shooting outward, look at the disk of the wheel it received all the splashing that the pedestrian was spared



Here is a mud-brush that is attached by wires to the hub. The spokes of the wheel show through, hence the brush is not conspicuous. It catches all the mud that the regular mud guards at the sides of the car fail to get

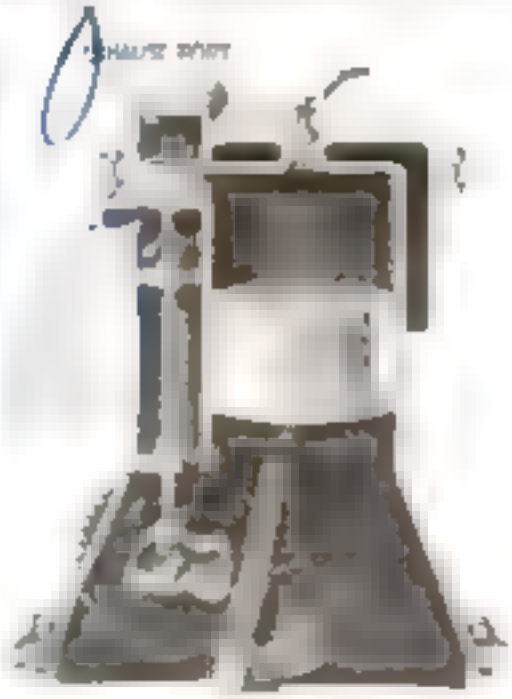
If you look closely you will see that there is a rubber shield along the outer rim. This shield is another type of mud-guard for protecting the passer-by

Muddy water hits this metal protector with such force that it shoots out backward. The man at the side is saved, but how about the one who steps out behind the car?

Four-Cycle Engine Piston-Valve

THE valve shown in the picture is intended for a four-cycle internal-combustion engine, although in many respects it resembles the slide-valve of a steam engine It controls the intake, compression, pressure, and exhaust strokes of the engine, and contains fewer parts than the poppet valves in present use.

The cylindrical valve-chamber is made integral with the engine-cylinder casting. Two cylinder heads on the piston-rod of the valve are so spaced that the chamber between them alternately receives the gas from the intake port, or the exhaust gas from the engine. The movements of the valve are guided and positively determined by a cam, the raised margin of which engages between two rollers at the end of the piston-rod



Noiselessly this valve, which has no springs and is operated positively by a cam, controls intake, exhaust, and pressure of gas in the engine cylinder

There are no springs and few movable parts in this valve Its action is positive and its movements are always accurately timed. As there are no springs, the valve operates noiselessly and as there is no spring pressure to overcome there is a considerable saving in the power necessary to operate the engine. Practically all wear is confined to the cam, which consists of a single piece and can easily be replaced by a new one from time to time

In the accompanying illustration the cylinder is shown as an integral part of the engine casting and placed parallel with the engine cylinder.

This Oil-Cup Makes Lubricating Easy

LUBRICATING an automobile is extremely messy and disagreeable work The unpleasant features of this work are reduced to a [illegible] by the forre oil-cup [illegible]

To fill the cup, lift [illegible] cover until the filling [illegible] exposed, fill [illegible] oil by [illegible] the cap [illegible] closed [illegible] p is pushed down, the [illegible] pressure to the parts [illegible] lubrication. The cup is dirt-, dust-, and rust-proof

This oil-cup is easy to fill without soiling the hands, and by pressing down the cap the oil may be forced to any bearing or other part that requires lubrication

Automobile Wheels Are Now Made of Plywood

THE newest development in automobile and motor-truck wheels is one made of layers of wood, glued together under great pressure. The wheel is of the disk type, and is composed of seven thin circular slices of wood, the grain of each piece running counter to the next one.

This process of laminations makes the complete disk into a strong, non-separable, non-warpable, but resilient whole, which is claimed to be able to withstand 100 per cent more side strain than the spoke wheel. The weight of the new wheel is approximately the same as the spoke wheel. Any standard demountable rim can be used the same as on the spoke wheel. The hub construction is the same, except that a right-angle tire-valve is provided.

Motor-trucks and automobile wheels are being constructed of plywood

This doctor has just called up his office and is recording the calls that have come in

The top of the car will serve for the placing of the wireless antennae requiring merely a post at each corner

Equip Your Car with Wireless

ANY enclosed automobile can now be equipped with a wireless telephone outfit

The instrument on this automobile will work successfully up to five miles and use only a small part of the automobile battery's current. Anyone can hear as plainly as over the telephone.

The young men in the picture above found that it is not necessary to have antennae high up. Their experiments proved that the wires stretched around the top of the automobile were successful in picking the sound waves out of the air and they then solved the antennae problem by running four parallel copper wires around the top of the car on six-inch posts fastened to the corners. They grounded the set to the automobile engine as is done in airplanes.

It is an easy matter to sit in a car thus equipped and ring up one's home, provided you are within the five-mile zone

Motor-Polishing the Car

PRACTICALLY no "grease" is necessary when this new polishing machine is put to work. It works fast and covers many times the area that could be covered by a man using a polishing-cloth. But it takes one man can polish seven cars a day.

Compressed air is used to drive the mechanism which propels two feet, or "polishers" which work in opposite directions. All of the parts are made of an aluminum alloy that makes the machine light and easily handled.

One man can polish seven automobiles a day with this air-driven polisher

Putting a Camel in the Automobile

ELLING O. WEEKS, a professional aviator, worked for five years on his device for automatically keeping the automobile radiator full of water before it was perfected. It consists of two main parts, a tank and a float-controlled valve, connected with piping

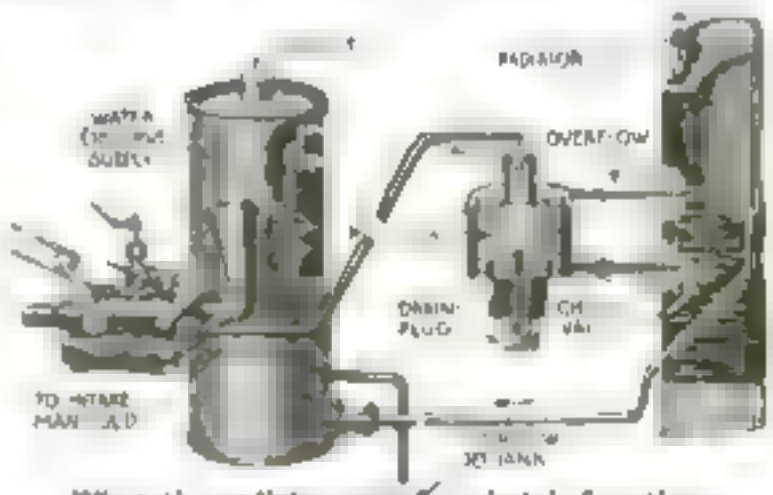
The tank is placed vertically at the bottom of the dash under the engine hood and is piped to the radiator overflow pipe. The tank thus catches, condenses, and holds all steam and water escaping from the radiator

The float-controlled valve is attached to the top tank of the radiator under the engine hood and is connected by tubing with the intake manifold of the motor.

As the water-level in the radiator lowers, the float-controlled valve opens, permitting the motor to create a partial vacuum in the top of the radiator and draw back sufficient water from the vertical tank to refill the radiator. As soon as the radiator is again filled, the float in the valve rises and shuts off the motor suction until the water again lowers in the radiator

The vertical tank carries a reserve supply of water and is fitted with a whistle that, when it blows, warns the driver that the supply of water in the tank is exhausted. This occurs before the radiator runs low, so that the engine is always protected against overheating due to loss of cooling water

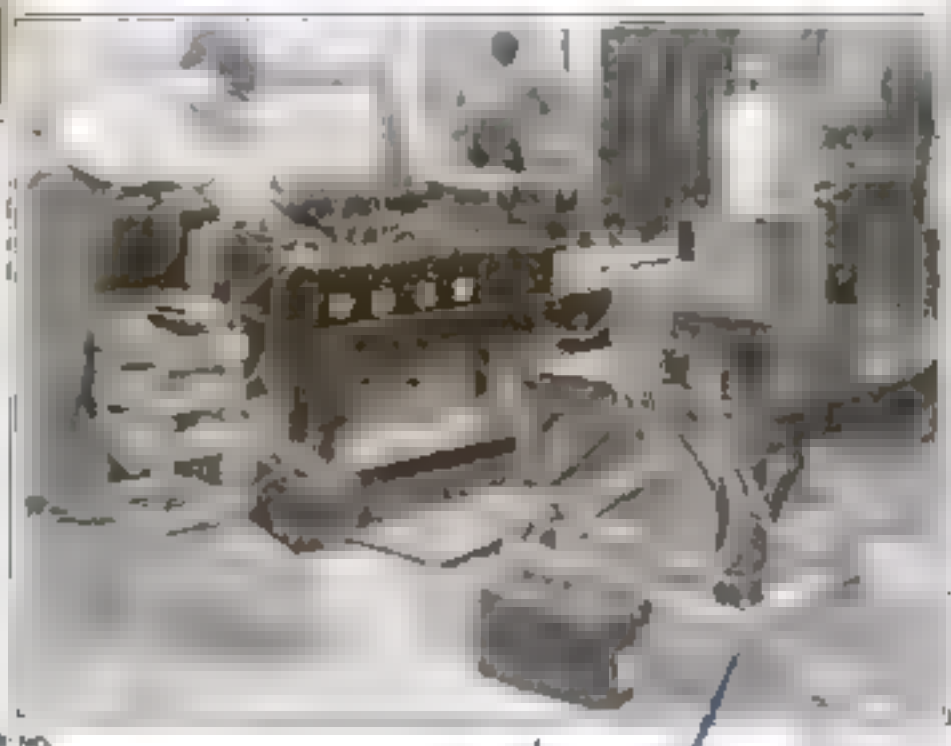
In creating the suction in the upper part of the radiator, the float-valve also feeds into the intake manifold a very slight amount of moisture, which tends to increase the engine power, when converted into steam by the high explosion temperatures, as well as to prevent the formation of carbon with all of its attendant harm to both the spark-plugs and the cylinders.



When the radiator runs low but before the water is exhausted a whistle warns the driver

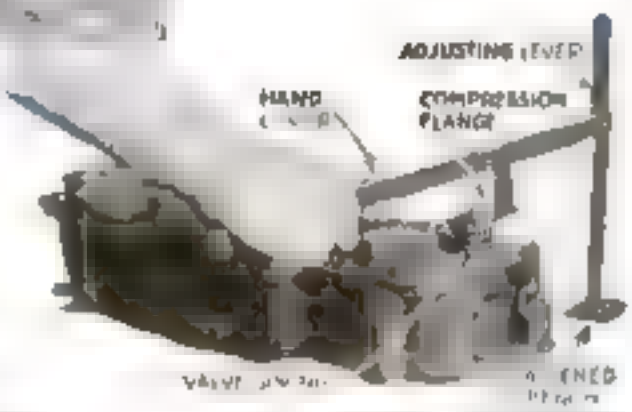
Items of Interest to the Automobile Owner and Driver

Here is a tire-chain device that does not put the chains but connects them. A double lever draws the chains together, leaving plenty of play for locking them



The air-chuck slips over the air valve, gripping securely and locking itself on, preventing waste of air from the compressor. To release it, you push up small lever

In replacing the [illegible] steam boat [illegible] battery [illegible] steam [illegible] steam [illegible] by [illegible]

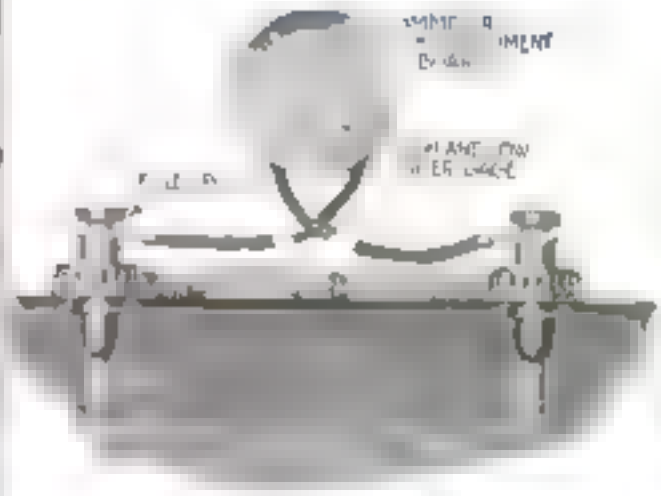


In [illegible] of [illegible] pipe [illegible] The [illegible] of the pads against the cylinder wall

A tool [illegible] for [illegible] of [illegible] The [illegible] can be [illegible] at different points [illegible] the upright

Here's how [illegible] have been made [illegible] one [illegible] shoes [illegible] be [illegible] on any car

A fan, attachable to the hub of metal wheels, that consists of three paddles, which throw the air against the wheel rim, cooling it



An American brake that is operated hydraulically instead of by rods and levers. The four-wheel brake enables the driver to stop a car in half the usual length

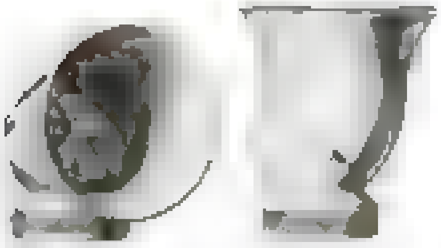
This [illegible] of the [illegible] the battery [illegible] steamer [illegible] creating [illegible]

Mounted on the instrument board with the speedometer and clock, this device warns the driver when the water in the battery is low or when the battery is run down

When You Want Expert Advice About Your Car

IN these pages of ideas about automobiles and motor-trucks the Popular Science Monthly endeavors to help its readers solve problems of maintenance and repair. But there must be special cases that are not covered, and we invite you to write to the Automobile Editor and let him advise you.

If you wish to know more about the devices pictured here, or if you want to ask questions, write. Some answers are given on page 79.



On the left is a new funnel cap. A wisp of steam warns when the engine becomes overheated. The funnel, as seen on the right may be swiveled to receive a supply of water

This is said to be the largest motor-truck ever [illegible]. Although its capacity is [illegible] than three tons, it can carry at one time two hundred and sixty barrels, arranged four rows high and five wide

An anti-theft device attached to a front wheel. [illegible] protecting the [illegible] work [illegible] is a noise-making device caused by the lock coming in contact with the roadway

Fitting [illegible] the [illegible] down [illegible] instantly [illegible]

Made of pressed steel, this collapsible pump [illegible] operate [illegible]

Attach this device to your spark plug to increase the engine power by sending an electric current through the spark plug in one intense spark instead of in many weaker oscillations

If you are subject [illegible] beneath your [illegible]

When the wheel squeaks because of loose spokes, there is a compound that is claimed to permanently tighten the spokes

All kinds of electrical equipment [illegible] be [illegible] in the [illegible] steering stand, which is the invention of a Chicago man

A new make of car provides a place for storing away the side curtains of an automobile in the back of the front seat

A spray-tank carried on a trailer is efficient in large orchards the machinery is driven by the tractor motor

Spraying the Fruit-Trees from a Trailer

THE combined tractor and spraying-machine pictured above has been used with great success recently in large orchards of the West. The spray-tank is hauled on a trailer in the rear of the tractor, while the spraying machinery, driven by the tractor motor, is attached to the forward end of the tractor.

This machine is more powerful than the older devices operated by gasoline motors. Orchardists maintain that the fluid thus forced on the trees in a fine spray is more effective than when it is applied in drops.

The hybrid machine is considered practical for use, especially in large commercial orchards.

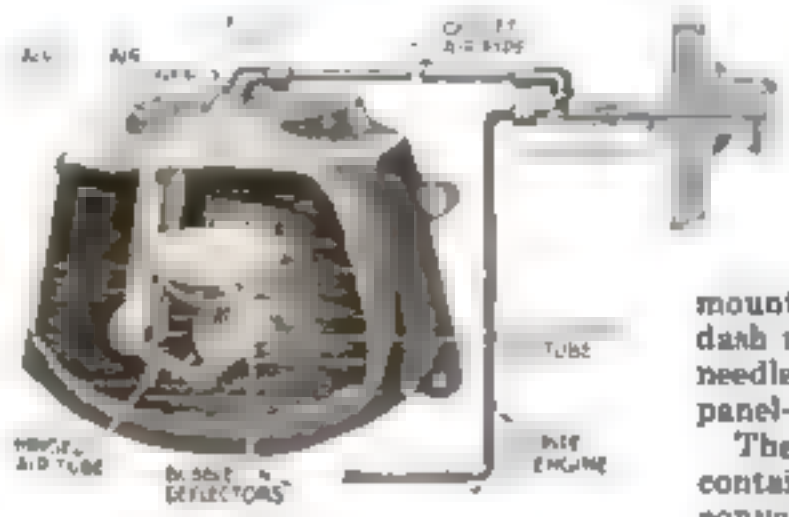
Automobile Fuel Moistened

ONE of the best worked-out examples of the several devices now on the market for humidifying the air mixed with the fuel vapor fed to the automobile engine is shown below. Its purpose is to feed to the fuel mixture an auxiliary supply of air uniformly saturated with cool water vapor, which tends to increase the engine power when the water vapor is turned into steam at the moment of explosion and to reduce the amount of carbon deposit through a chemical combination of the oxygen of the water and the carbon into a gaseous product of carbon monoxide or dioxide.

Its special feature is a humidifying air-sprayer, the purpose of which is to supply the water vapor at a uniform rate. This is accomplished by spraying a stream of air into many fine bubbles at a constant depth below the surface of the water so that these bubbles always rise through the same depth of water whether the water container is full or nearly empty. This tends to effect perfect vaporization. One filling of the water-container is sufficient for four or five hundred miles of average driving.

The apparatus consists of two main parts—the water-container, which is mounted on the front side of the dash under the engine hood, and a needle-control valve, mounted on the panel-board within the driver's reach.

The filling trough at the top of the container is designed to permit the convenient pouring of water from any position. The container is readily drained through a petcock at the bottom.



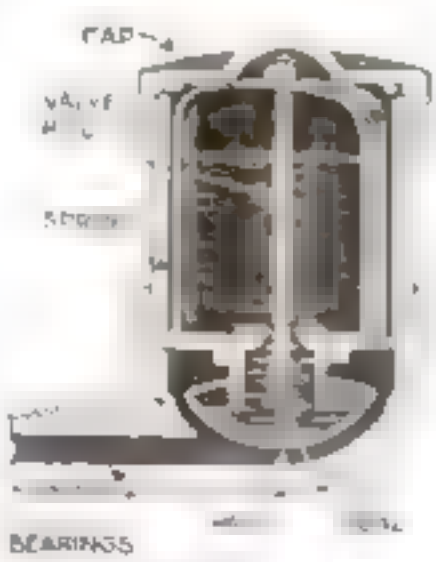
By feeding to the fuel mixture a supply of air saturated with water vapor, it increases the engine power and reduces the carbon deposit

Vibratory Motion of the Car Feeds the Oil

RECENT attempts of automotive engineers to eliminate grease from chassis lubrication have brought out many different types of thin oil lubricators, of which that shown at the right is the newest.

This device works on the splash system, the vibration of the car forcing a small amount of oil over the edge of a reservoir in much the same manner as water is spilled out of a saucer. Oil is not fed to the bearing when the car remains stationary. The feed when moving, however, is directly proportionate to the amount or degree of vibration.

As shown in the accompanying section view, the oiler consists of a cylindrical bowl with a screwed-on cap. As the cap is screwed down it forces down a rod in the center of the bowl. This rod extends through the bottom of the bowl and acts as a valve to permit the oil to flow down through a plug into a saucer-shaped reservoir, which with the plug forms an automatic level seal that prevents the oil from flowing over the edge of the saucer when the car is standing idle. When moving, the oil is splashed over the edge of the saucer and down into the bearing, more oil from the cylindrical bowl above flowing down and taking its place in the saucer.



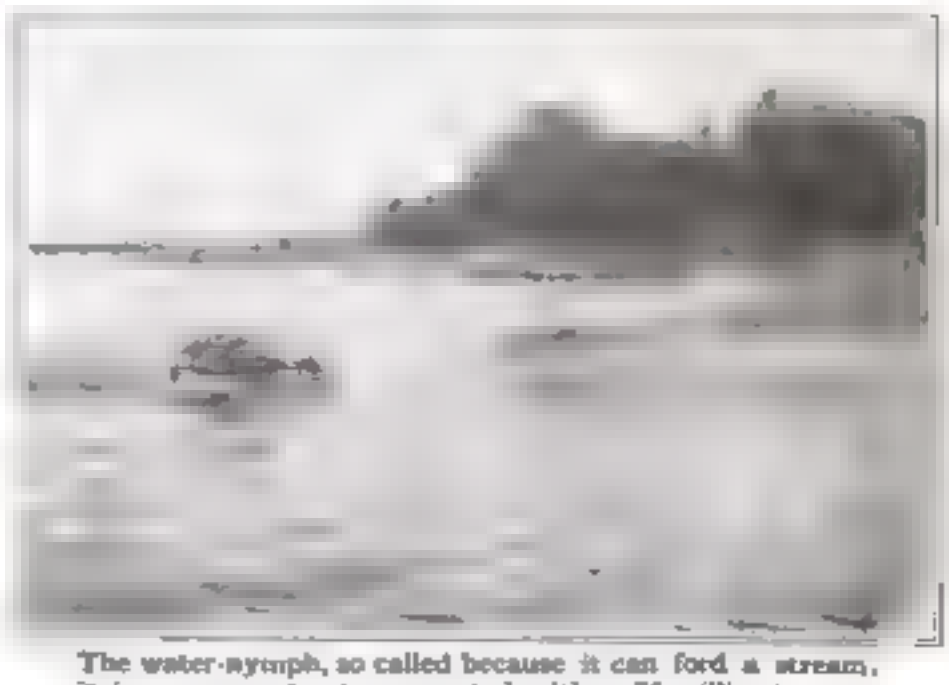
This oil lubricator works on the "splash" system, the vibration of the moving car forcing oil in small amounts over the reservoir

The Amphibious Tractor

AT first glance the object in the stream looks like some strange boat. It is one of the new government tractors for carrying a 75-millimeter gun.

The Ordnance Department made this creeper tractor the water-nymph. The ignition wires, distributor, and spark-plugs are waterproofed with a special compound and the carburetor is water-tight. The eight-cylinder engine exhausts directly into the water.

The vertical pipe on the side is an extension of the intake pipe, and any stream of less depth than the height of the pipe opening can be forded.



The water-nymph, so called because it can ford a stream, is a creeper tractor mounted with a 75-millimeter gun

What Is Your Running Alinement?

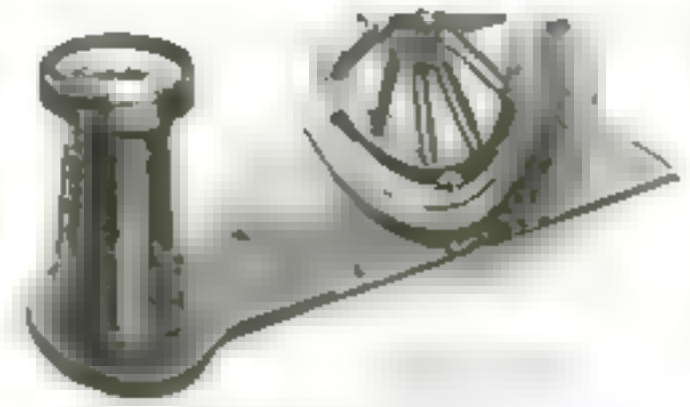
To reduce tire wear, measure the action of your automobile wheels

WHEN automobile wheels are out of proper alinement, the result is excessive tire wear. Most corrective methods, however, have measured the alinement only when the wheel was stationary. This is not sufficient to reduce tire wear, because the tire does not wear when the wheel is stationary, and because the true or running alinement may vary considerably from the stationary alinement.

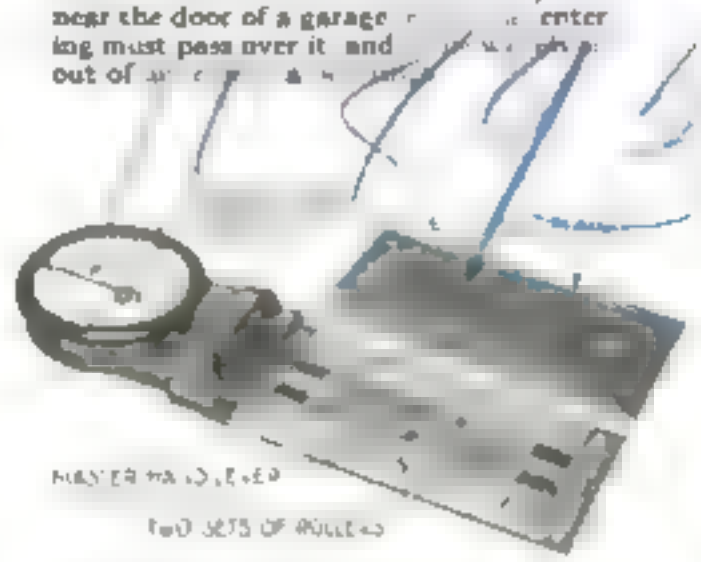
Millions of dollars in excessive tire wear have been wasted in the United States, because there has been no convenient method of measuring running alinement.

Wheel misalinement occurs as a result of wear in the steering mechanism, wheel-bearings, etc. If wheels are allowed continually to bump into the curb, misalinement is produced, as well as when improperly adjusted tie-rods connect the front wheels

It was by noticing the sand pushed to one side of the wheel track when running a car over a beach that the full significance of the difference between stationary and running alinement was realized, and led to the invention of an instrument to measure a car's running alinement. The instrument consists of two parts, a plate over which the wheel is run, and a dial to indicate the degree of misalinement. It may be used with cars having either pneumatic or solid tires, and is made in a large size for permanent location in the runway of a garage, and in a small portable size for mechanics.



When an instrument of this kind is placed near the door of a garage [illegible] entering must pass over it and [illegible] out of [illegible]



Showing the mechanism inside of the alining machine. As each wheel passes over the plate a set of rollers transfer to the dial a faithful indication of its alinement

Both sizes work on exactly the same principle. The part over which the car wheel is run consists of two plates, the upper one of which moves over the lower on two sets of rollers as the wheel passes over it. The movement of the plate actuates a lever connected with the master hand on the dial, which in turn operates two smaller hands, one moving to the left and indicating how much the wheels are toed in, and the other moving to the right and indicating how much the wheels are toed out. The hands remain stationary in the positions as set by the master hand until the reading is taken, when they may be returned to zero by pressing a lever.

The top plate and rollers are automatically brought back to their original positions.

Write to Us About Your Motor Troubles

If you have a motor-truck or automobile problem, let the Automobile Editor solve it

Why Disk Clutches?

Q. What have been the fundamental causes behind the growth in popularity of the wet and dry metal disk clutches in automobiles today as compared with the type used almost exclusively several years ago?—D. F. L., Reading, Pa.

A.—The advantages of the multiple disk type of automobile clutches as compared with the cone design may be briefly summed up as greater ease and smoothness of operation; less liability to get out of order; greater compactness and a reduced spinning tendency due to less inertia of the driven member due to lightness and small diameter.

Block Engine Castings

Q.—What are the advantages and disadvantages of casting automobile engines in block as compared with casting them singly or in pairs?—K. L. H., Peoria, Ill.

A.—Engines with four cylinders cast in one piece are more compact and generally lighter in weight than when cast singly or in pairs. Because of the greater compactness, there is greater engine strength and rigidity. Because of the large size of the one casting as compared with the single cylinder, greater care must be exercised in the actual foundry or casting work. If one cylinder is cracked or out of true in a four-cylinder block, the entire block must be scrapped. Greater care must also be exercised in designing the water manifolding around the cylinders so that distortion due to unequal heat dissipation is eliminated.

Proper Brake Clearances

Q.—What is the proper clearance to allow on external-contracting automobile brakes?—F. G. G. Cleveland, Ohio.

A.—On most brakes the clearance generally allowed varies from 1/64 to 1/16 inch all around. It is necessary that the clearance be the same all around the drum to prevent binding or rapid wear of the brake lining.

Irreversible Steering-Gears

Q.—What is meant by an "irreversible" steering-gear?—G. F. O., Yonkers, N. Y.

A.—An automobile steering-wheel is said to be "irreversible" when the same power exerted to turn it at the wheel will not turn it when applied to either one of the front wheels or when the steering-wheel is not turned by the ordinary road wheel impact. The degree of 'irreversibility' is determined by the reduction between the steering-worm and gear. The greater the reduction, the less reversible the gear

When Trailers Pay

Q. How can you tell whether or not it will be an economy to haul a trailer behind a motor-truck in certain kinds of work in order to deliver greater loads?—H. J. New York.

A.—Each proposed installation of trailers must be studied alone. Speed, roads, and grades are the three most important factors to be considered. "When Motor-Truck Trailers Pay," published on pages 79, 80, and 81 of the Popular Science Monthly for March, 1921, will enable you to decide.

Cooling the Engine

Q. What are the advantages and disadvantages of the air-cooled car as compared with the water-cooled type?—J. S. East Orange, N. J.

A.—The advantages claimed for the air-cooled engine are its light weight; freedom from leaky water connections and frozen radiators and pipe lines, and higher engine efficiency or fuel economy by reason of the high operating temperatures, tending to vaporize fuel more completely. Among the disadvantages claimed by those who favor the water-cooled engine, are the need for greater care in operation, tendency of preignition when the engine is run for an extended period and at high speed, and lubrication troubles.

Protecting the Battery from Mud and Water

ON some cars the battery is exposed to the mud and water thrown by the wheels. On such cars the top of the battery quickly becomes covered with mud. That this condition does not tend to lengthen the life of the battery is shown by the fact that some of the manufacturers provide a means

Keep your battery in good condition with this little cover, it will save money

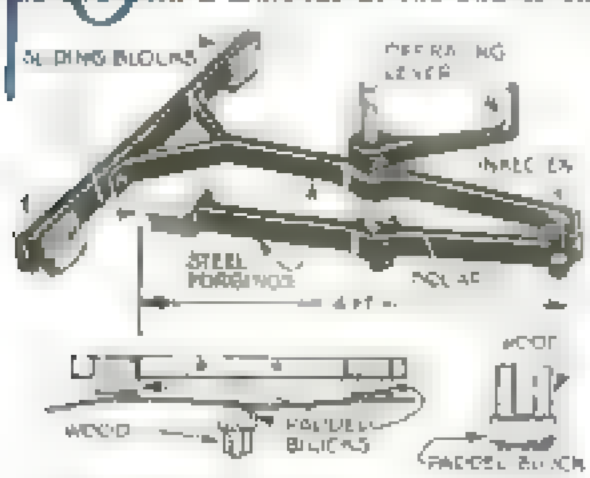
of preventing mud and water reaching the battery, by placing a cover over it or placing it under the seat.

Owners of cars with unprotected batteries may protect them in the following simple manner. Fasten thin boards or pieces of tin to the bottom of the footboard, so that the battery is surrounded by them. These should be long enough to reach 6 in. or more below the top of battery. All the mud thrown by the tires is then intercepted before it has a chance to reach the battery.—PAUL GORTON

Bent Fenders and Bodies as Good as New

THE tool shown in the appended sketch was devised for the purpose of removing bulges and bends in the fenders and bodies of automobiles without the least damage to the paint and without the tool marks so common to jobs done with the usual hammer and blocks.

This tool consists mainly of two steel forgings about 4 ft. long hinged together at one end with a crossbar at the end of one



Bent fenders make a car look old keep the fenders on your car in shape with this simple tool

part. A screwbar midway of the length of the forged arms, with a threaded nut and lever, has for its purpose the closing up of the arm ends.

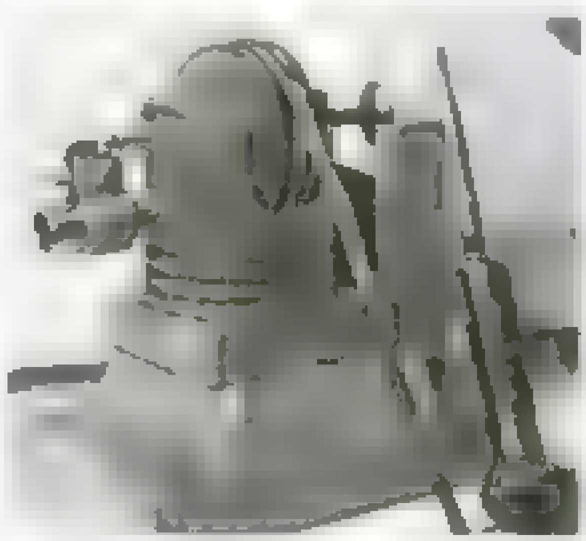
Padded wooden blocks are arranged to be made adjustable. In use the single block is placed on the reverse side of the bend or buckle, which is the place of least resistance, and the opposite blocks at the extremities of the bend. Pressure applied through the screw will return the metal to its former shape, frequently with out little resort to additional means.

The steady application of the pressure and the pads on the blocks protect the paint without further disfigurement to the body.—G. A. LUERS.

An Old Piston Turned into a Lathe

IT became necessary a short time ago to reface the valves of an automobile engine, so I decided to transform an old automobile piston into a lathe for refacing the intake and exhaust valves. I drove the piston-pin out on one side, made a strap to go around it and engage in the valve-stem key seat so that the valve could not move endwise.

Boring two holes in the top of the cylinder, I fastened it to blocks. I cut out



An old piston can be made to serve as a lathe, it is a useful addition to the garage

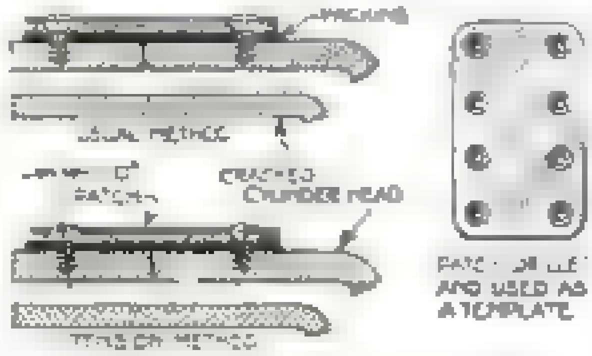
two sides to make room for the pulley and attached a tool-rest. A facing tool or a small flat file, ground on a slight bevel, could be used.—HIRAM BRACK.

How to Repair a Cracked Water-Jacket

CRACKED water-jackets should be promptly repaired by putting a patch over the crack. To prevent the extension of the crack under the patch, a tension patch should be applied, the screws of which are set at an angle of about 10 degrees to the surface of the jacket.

The holes for the screws that hold the patch in place should be drilled with great care at an angle of about 10 degrees. When the screws are put in and tightened, they will draw the edges of the broken parts together, making a secure joint and preventing any extension of the crack.

The use of countersunk head screws is advisable, as this affords a seat for the screwhead.—G. A. LUERS



A cracked water-jacket is a knotty problem to the motorist, here is a simple way of making a repair

Let the Automobile Pull Itself Out of the Mud

ROADS in the country are by no means always in perfect condition. Every driver of an automobile who has attempted cross-country tours, especially after an extended period of rain, knows that the

Another way of getting out of the mud: hitch the car to a tree and the motor does the rest

danger of becoming stalled in the mud is ever present.

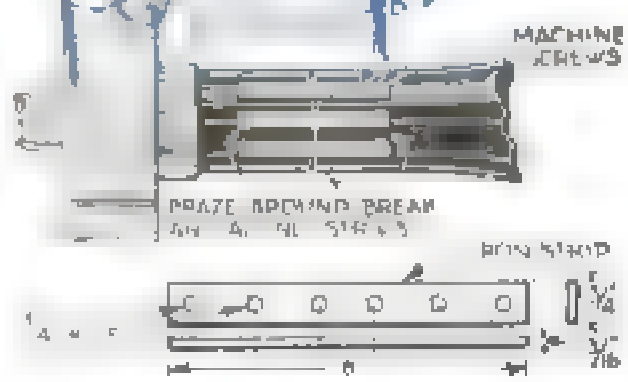
The device shown here, which is the work of an inventor in the southwestern part of Missouri, where muddy roads are frequent, offers an excellent suggestion.

In front the car has a spool or spindle on a horizontal shaft on which a long piece of cable is wound. The spool can be rotated by a worm and gear, driven by the engine-shaft. When the automobile becomes stalled in the mud, the cable is unwound, the free end is fastened to a tree, telegraph-pole or some other fixed object.

The engine is coupled to the worm shaft and started, winding up the steel cable, thus effectually pulling the car out of the mud.—C. A. BRIGGS.

Repairing a Broken Rear-Axle Housing

WHEN the rear axle housing of my [illegible] broke [illegible] it in the [illegible] here [illegible] the [illegible] drawing wire



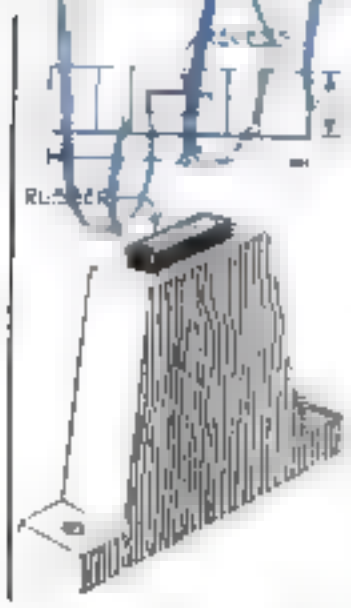
One of several methods of repairing a broken rear axle housing is here illustrated

tight from one brake drum to the other. Then I drilled and tapped several series of ¼-in. holes in the housing, three on each side of the break for each of the strips that were intended to hold the broken parts together.

The strips, of which I used four, were 8 in. long and ¾ in. wide and 3/16 in. thick. In each of the strips I drilled six holes ¼ in. in diameter to match the holes drilled in the housing. The strips were screwed to the housing—and then I brazed all the way around them.—A. J. WEISSINGER.

Make a Door-Check and Save the Wall

EASILY constructed and very practical is this door-check to prevent the knob from coming [illegible] the wall. It may be made from a piece of wood preferably [illegible] 4 by 6 in. At the top cut out a piece 1 by ¾ in. and ½ in. deep.



To prevent a door from injuring the wall

Cut the block in the shape shown in the illustration. Take an old rubber heel and cut from it a block of about ¾ to 1 in. by ¾ in. Glue this into the slot and paint the door-check the same color as the wainscoting to which it should be attached by screws.—M. J. SILVERSTEIN

A Drain-Spout Made from an Old Tire

FROM a quarter section of an old tire I improvised a drain-spout as shown in the illustration. I selected the best quarter of a tire and cut it carefully so as to obtain a smooth section at right angles. One end of the tube was slipped over the lower end of the leader pipe and securely wired to it. The spout was in every way as satisfactory as one made of tin or galvanized iron.—LEON ADELMAN

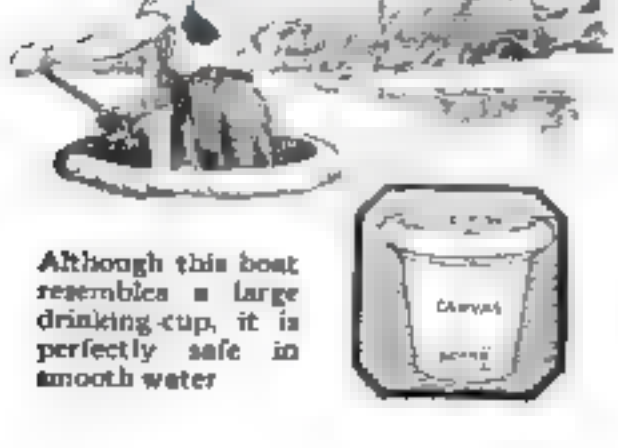
How the drain-spout was constructed

Building a Goofah from an Old Auto Tire

SHOULD you not know what a goofah is, I will inform you that it is one of those primitive boats of circular form used in the Orient for carrying luggage, goods for the market, and even persons on the rivers and in quiet shore-protected parts of the sea. The illustration clearly elucidates the construction of this boat.

An old tire, which, however, must be air-tight, forms the floating frame or gunwale. The body of the boat consists of waterproofed canvas that is sewed to form a bag of the same diameter as the tire and deep enough to accommodate one person in a crouching or sitting position. The upper part of the canvas bag is lapped over the tire and securely sewed.

The bottom of the boat is formed by a piece of board cut round. The lower edge of the canvas bag is lapped over the edge of the boat, and cemented to it. The boat is collapsible and light enough to be carried on long trips.—JAMES A. MONTGOMERY



Although this boat resembles a large drinking-cup, it is perfectly safe in smooth water

Workbench Cast-Offs Make a Turn-Buckle

IF a turn-buckle is needed, one can be constructed from parts found about any workbench.

Procure a stove-bolt of the size desired, fit it with a nut, and find two large washers that will slip easily over the bolt shank.

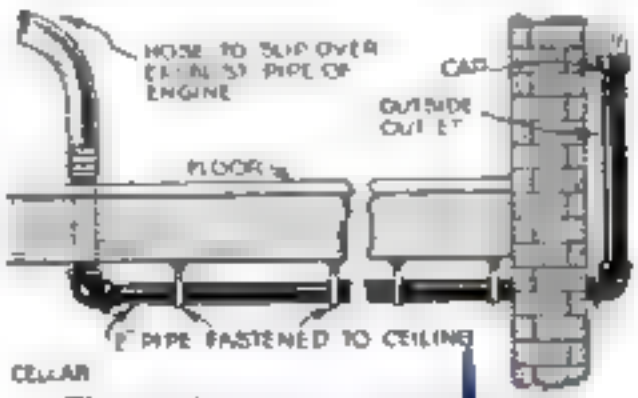
Drill two holes in each washer, exactly opposite each other. Then make two loops of steel wire about the shape indicated, slip the two ends of these loops into the holes in the washers and rivet them.

A long stove-bolt with its nut, two washers, and two ends of heavy steel wire are the constituent parts of this improvised turn-buckle

Assemble these various parts as illustrated in the picture above and the turn-buckle is complete.—L. B. ROBBINS.

One Method of Removing Fumes from the Air

GARAGES and buildings in which fire-engines are housed invariably contain air that has been vitiated by the fumes of combustion from the exhaust of the engine.



The ventilator here illustrated will prevent the fumes from the exhaust of the engines from poisoning the air in the garage or engine station.

Here is a method to remove the noxious gases from the atmosphere.

A 4-in. pipe should be laid under the floor and past the outer wall of the fire-house. The end of the pipe inside the fire-house should have an extension at right angles through the floor. This extension should be placed so that it penetrates the floor at the place immediately underneath the exhaust of the engine. The pipe is connected with the exhaust by a rubber hose that slips off the exhaust whenever the fire apparatus leaves its quarters.

The end of the pipe outside the building may be extended to the roof, or to some place high enough to produce a draft that will carry off the gas.

Making a Swing from a Discarded Tire

WE all remember the swing hung from a gnarled apple-tree out on the farm where we spent our earliest summers. A modern improvement of the old-time swing is made from an old discarded automobile tire, provided it is not in too bad a condition.

Boys and girls will get a great deal of fun out of a tire swing

The tire forms a more comfortable seat than the narrow board of our early experiences, and the young rider can cling comfortably to the rounded sides.

Suspending the tire from a single rope permits of a variety of gymnastics, the rotating motion being very popular with the small boy and girl.—LEON ADELMAN

Rubber Mats from Pieces of Old Tires

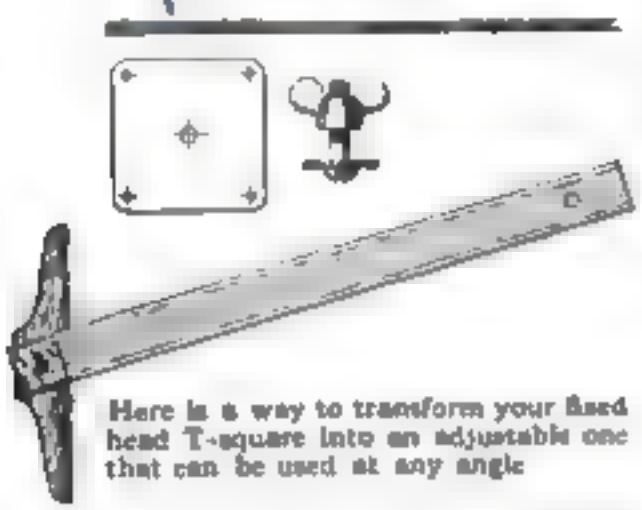
IF you have some old automobile tires, you can make good use of them by making one or more mats for the entrance or front hall. First, make a rectangular frame of heavy iron wire. Galvanized wire is better than plain wire as it will not rust. Then strip all the heavy rubber parts from the fabric of the tire and cut the rubber in pieces 1 in. square or larger, also cut an equal number of smaller pieces ½ in. square. Punch two small parallel holes through each large and small square and string them, alternating small and large pieces, on two wires. Twist one end of the wires around the heavy wire of the frame, stretch them across, and make them taut by twisting the other end around the opposite side of the frame. According to the size of the frame 10 or 15 rows like this will be required which should be so spaced that about ½ in. space is left between the pieces of rubber.

Old automobile tires may be utilized for making this mat

It is advisable to use galvanized iron wire also for stringing the rubber pieces. The accompanying illustration shows the appearance of the mat.—E. T. JONES.

How to Make an Adjustable Head T-Square

YOU can make an old T-square into a most useful adjustable head instrument, as shown in the illustration. First remove the blade from the head and true up the edges with a fine set plane, sandpaper, and a true straight edge. Then attach a square plate of thin brass to the end of the blade by four small flat-head machine screws or copper rivets, being careful not to spoil the blade during the operation. Then drill plate, blade, and head, making a hole about ¼ in. or ⅜ in. in diameter, to take a short



Here is a way to transform your fixed head T-square into an adjustable one that can be used at any angle

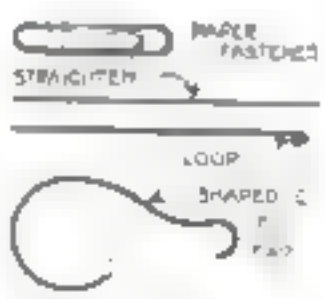
bolt and wing nut. Place a washer under each end of the bolt and the device is complete.

The blade may be trued up again at any time by removing the wing nut and head.—H. H. PARKER.

Improvised Eyeglass Chain from Paper-Fasteners

A STRONG wind, such as is encountered on a boating-trip or automobile tour, makes one wish for some means of holding the glasses on.

It was just such a strong wind that caused this emergency chain to be evolved. One man happened to have in his pocket two paper fasteners, one of which was straightened out as shown. A loop was then bent in one end with the aid of the automobile-kit pliers. The wire was then shaped by hand to fit the wearer's ear. Four fasteners were found to be long enough to stretch from the earpiece to the glass.

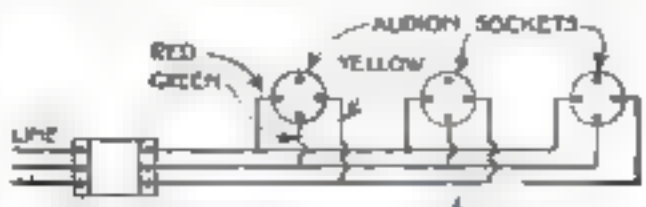


This will keep the wind from blowing off your glasses

Would You Like Extensions on Your Telephone?

WHEN a private desk-type telephone is installed, the instrument is placed as conveniently as possible. Yet it is often desirable to telephone from several points.

An old audion socket and bulb can be made into a good extension by connecting the three wires from the telephone to the bulb base and three wires from the bell box to the sockets, with a socket located at every point where it is desired to locate the tele-



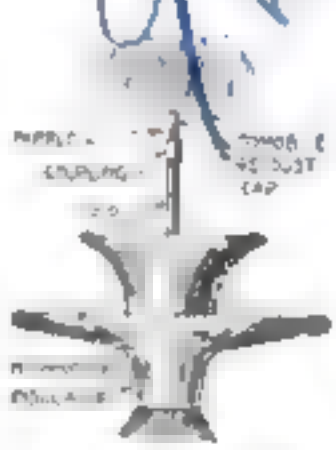
These extensions may be used only in connection with private telephone lines

phone for instance, at the desk or sewing-room during the day, in the living-room in the evening, and near the bed at night.

The only important point to watch is that the base and sockets are connected so that the color of the wires is preserved throughout; for instance, always red to red, and green to green. The accompanying illustration shows the scheme.—V. H. TODD.

An Easily Constructed Fountain for the Lawn

THIS fountain has a flat tile bowl or basin formed by placing a high-voltage insulator about 18 in. in diameter over a ¼-in. pipe that is connected with the water-line.



Although made of simple material this fountain is attractive

On the end of the pipe is a coupling having a small nipple and over this is attached an automobile-tire dust-cap, which is pierced with many holes about as small as the point of a pin. This cap fits down to the shoulder of the coupling

To Prevent Shoes from Losing Their Shape

EVEN the most expensive shoes soon lose their attractive appearance through wrinkles and cracks that form above the heel part as the result of the constant bending and creasing in walking and careless handling in the removal of the shoes.

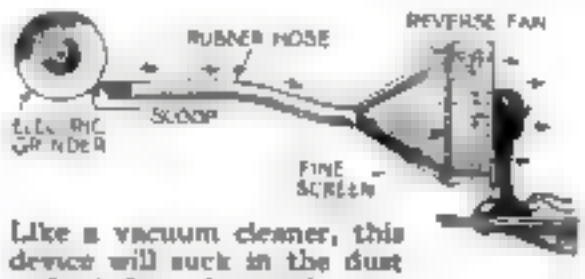
The forming of these creases may be prevented to a great extent by placing what may be called an invisible shoe-horn in the heel, as shown in the illustration. This support may be made of thin spring steel or the same kind of leather of which the counter is made and it will stiffen the back of the shoes sufficiently to prevent creasing.

The steel preserves the shape of the shoe

Homemade Exhaust Fan for the Lathe

BY the aid of a desk-fan a device may be constructed for removing by suction the dust and small particles of grit and grindings that otherwise would fill the air around the grinder to the detriment of the workman operating it.

The fan, when in reversed, furnishes the suction and draws the dust and metal powder through a funnel-shaped metal hood. The rubber hose, ending in a scoop, leads from the hood to a point just below the grinder. All dust particles are sucked in through the hose and are drawn toward the fan. They



Like a vacuum cleaner, this device will suck in the dust and grit from the grinder

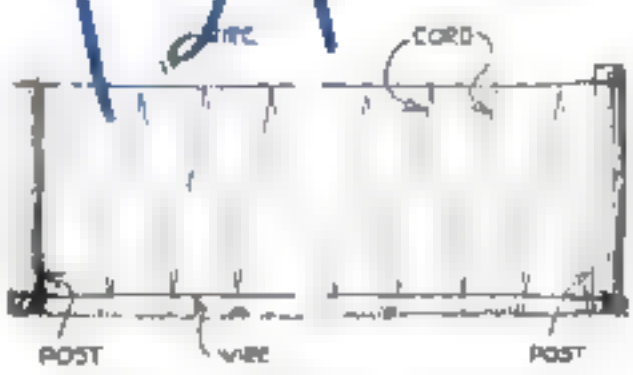
are stopped, however, by a fine screen in front of the fan and can be removed from the screen from time to time by gentle tapping.

This device has been used with remarkable success on a machine for grinding typewriter cylinders. But that is no reason why it should not be equally successful in cases where other materials are ground.—N. G. NEAR

Putting Up a Simple Trellis for Runner Beans

IN the accompanying illustration is a simple trellis that can be made in a shorter time than is usually required for such trellises, and that will be as effective as any.

Two posts are set at the ends of the rows, and a wire stretched taut between them at the top and bottom. Cord such as binder twine is then wound around the two wires in such a



An easy method of constructing a trellis for training runner beans

way that nearly vertical sections result as shown.

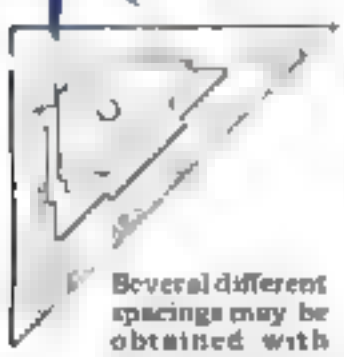
If the cord is spaced about a foot apart, it will be found to be as effective as woven wire or especially prepared frames, and at a cost that is trifling.

The posts may be simply stakes driven into the ground far enough to withstand the stretch of the wires, and, at the end of the season they may be stored away.—DALE VAN HORN.

Triangle that Gives Various-Sized Cross Sections

MANY draftsmen have need for a small and compact cross-sectioning device. The one illustrated is easily made from two celluloid triangles at a saving of expense.

A 45° triangle is cut as shown, the length and depth of the recesses depending upon the size of the triangle. A smaller triangle of the proper size is then cut as shown in the illustration, the length of the projections and their respective recesses being determined by the spacing of the lines that it is desired to draw.



Several different spacings may be obtained with these triangles

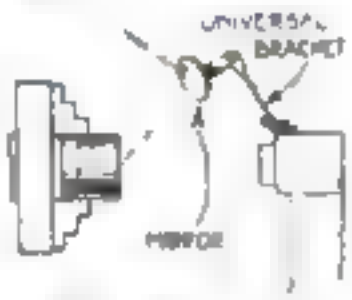
At least five different spacings can be secured by turning the inner piece.

In use, the palm rests on the lower left-hand corner of the large triangle and the forefinger is inserted into the hole of the smaller one.

By alternately moving one and holding the other triangle down, even spacing of the ruled lines is thereby secured.—WILLIAM MELAS.

Place a Mirror to Throw Light on Your Work

EVEN in well lighted shops it is sometimes difficult to obtain good light on inside work on lathes or other machines. Such cases would frequently be helped by obtaining the required light by reflection.



With this mirror light may be thrown on the work where it is most needed

The picture illustrates the method which was used in one particular case to illuminate the interior of a tube of metal on which some interior lathe work had to be done. The mirror was fastened to the tailstock of the lathe with a universal jointed bracket, so as to reflect either the light from a lamp or the rays of the sun into the interior of the work.—JOHN HOMEWOOD.

A Decorative Flower-Box for a Window

BUNGALOWS, front porches, and summer cottages may be made very attractive by this window-box.

Plan a box about 7 in. deep and the same width as the window. Fill it with plenty of good rich soil. Then plant a few pansy plants, a bunch or so of Shasta daisies, some mignonette, etc. Now take several ordinary baling wires, which will be about the right length for the purpose, when cut in two parts. Bend the wire, as shown in the illustration, in designs to suit your taste. Use fine wire to fasten the wires together. This gives the effect of wrought-iron work and is most attractive, even before the flower runners entwine them.

Climbing plants make this window-box very attractive

Give the wood a coat of gray or green paint and the box is finished.—M. A. OSBERG.

A Tinting-Tile Made from Developer Tubes

GLASS vials, test tubes, and especially developer tubes make ideal tinting-tiles. Any hard wood of the desired length, several inches wide,

Architects and artists will find this homemade tinting-rack very useful in their work

and an inch thick will serve as a base. Into this a sufficient number of holes are bored, ½ in. deep and a trifle larger than the diameter of the tubes. Both sides of the wood may be grooved to hold brushes, etc.

The base colors in corked tubes are placed at various intervals, and the other tubes, half filled with water, are used to hold the tints of the concentrated colors. A medicine-dropper is a handy medium to transfer the colors.—A. SCHAAL.

Have You Tried to Draw on Glass?

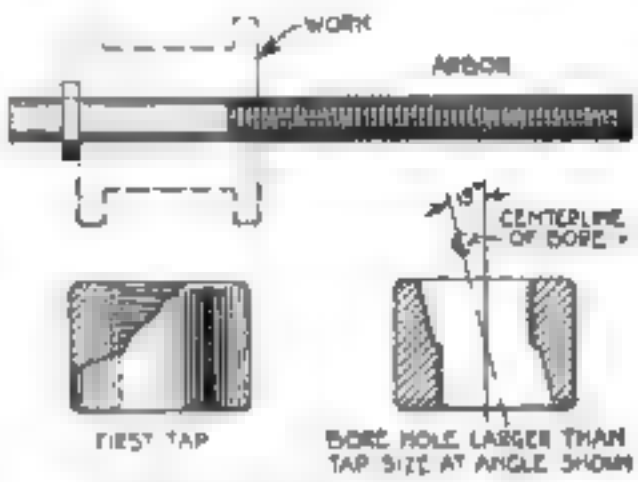
TO write on glass surface it is necessary to impart a certain degree of roughness to the surface. After repeated trials of various roughenera, a varnish of sugar was found to be the best method of obtaining this roughness.

Equal parts of white and brown sugar should be dissolved in water until the solution has a consistency equal to that of a thin syrup. Alcohol is added as a drier, and the varnish applied to hot glass plates.

Using a Clamping-Nut Saves Time

SUPPOSING it is required to clamp work of varying lengths upon a screw arbor, much labor can be saved by making the clamping-nut as shown in the accompanying illustration. First tap it as usual, then bore a hole larger than tap size through it at an angle.

The nut may then be slipped upon the arbor through the bored hole of the nut over the threading until it straightens itself against the work, whereupon

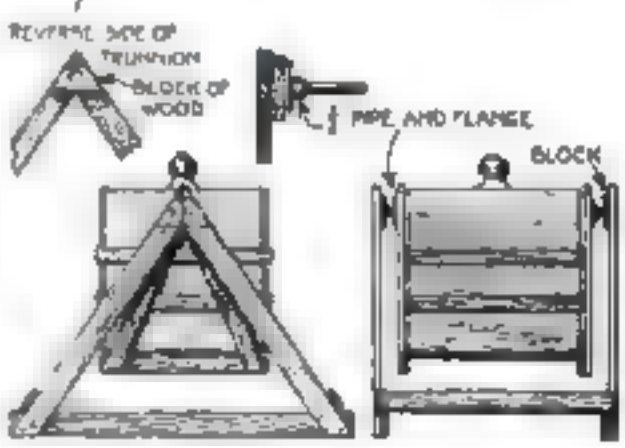


Much time and labor may be saved by employing the clamping nut described and illustrated here

the threads will mesh and the nut will hold as well as any other kind. To take off the nut, simply loosen it until the threads may be thrown out of mesh.—R. F. POHLE.

To Pour Acid from Carboys without Spilling

HERE is a self-explanatory illustration of a simple method used by a battery-charging station in southern Missouri to empty the large acid carboys in which battery acid is shipped. Distilled water is also received in similar containers. Before this tipping device was used, several



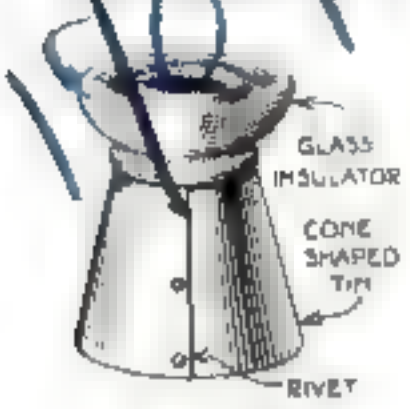
With simple tools this cradle for tilting carboys can be made from a few strips of lumber

carboys were accidentally broken, and there was always a good deal of waste in trying to remove a small amount of acid or water from the carboy.

This apparatus was made of soft 1 in. by 4 in. timber, but it could be improved by making the swinging cradle of strap iron, which would give added strength.—VERNON G. COX.

A Handy Acid Cup Made from an Insulator

WHERE acid is used in bench work at the repair-shop, particular care should be taken to provide a container that cannot easily be tipped over or broken. Acids are very destructive and when spilt on a bench may cause great damage.

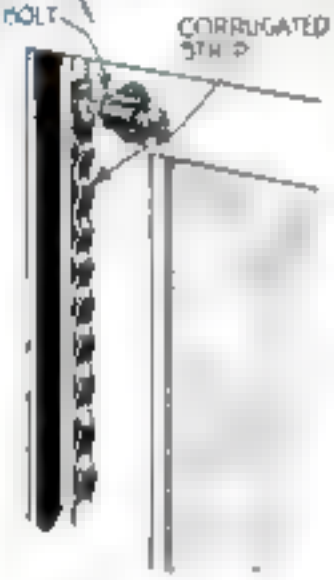


This acid cup is not easily upset

An excellent acid cup can be made from an insulator for electric wires set in a cone-shaped base made from a piece of heavy tin, as shown in the illustration. The insulator cup is not attacked by the acid and the broad and heavy base gives it stability

Holding the Window at Any Desired Height

MOST windows have but two stops for the window-sash and hence can be raised but two heights. From a strip of strap iron about ¾ in. wide and ⅛ in. thick can be made a clip that will make it possible to raise the window to any desired height. Such strap iron can be obtained at any shop where galvanized sheet metal is sold or used.



The belt engaging the strip holds the window

The strap iron can be easily bent into corrugations to receive the window-bolt, and countersunk holes should be bored at each end to receive the screws for securing it. The bolt should be fastened to the face of the lower window-frame. W. W. PARKER

Nuts Must Fit in Order to Be of Service

THE users of machinery should always bear in mind that an ill-fitting nut is practically of no value, and should never be used. A nut with 12 threads to the inch may be placed upon a bolt that has 10 threads to the inch and according to the thickness of the nut may be put on all the way or only part of the way. If it is forced on, the threads of the nut as well as of the bolt will be ruined. The picture illustrates that in a case of this kind only one thread can be in contact and that not all the way around, because of the different pitches. If the nut is so thick that another thread comes in contact, the second contact will be on the opposite side of the thread. It is obvious that the nut that holds merely by part of one or two threads offers no security. The thread is easily stripped and the nut slips off.

What happens when the nut does not fit

It should also be remembered that nuts that are too large, even if they have the same thread as the bolt, are objectionable. They hold only by the sharp edges of the threads, which are easily sheared or broken off.—N. G. NEAR.

Ferrules from Short Lengths of Pipe

SHORT pieces of steel pipe, if driven on the heads of tent-stakes will prevent them from splitting when they are driven into the ground. The pipe should be cut into pieces 2 in. long with a hacksaw. The pipe should be of a diameter to correspond with the size of the tent-stakes; 1 in. pipe is large enough for small stakes, while larger ones require a pipe of 2 in. in diameter.

Tent stakes should be protected by ferrules

The heads of the tent stakes should be trimmed to fit the pipe and should have a shoulder about 2 in. from the top of the stake. As the wood may shrink, it is advisable to drill a hole through the stake head and the ferrule, insert a nail, and rivet it at both ends, to prevent the ferrule from slipping off.

Build a Boat Driven by an Air Propeller

LITTLE boats driven by air propellers may be put together in a few minutes. The hull should be of soft light wood, preferably white pine, and it must be cut in the manner shown. It should be carefully sandpapered and shellacked so that it will offer little resistance to the water.

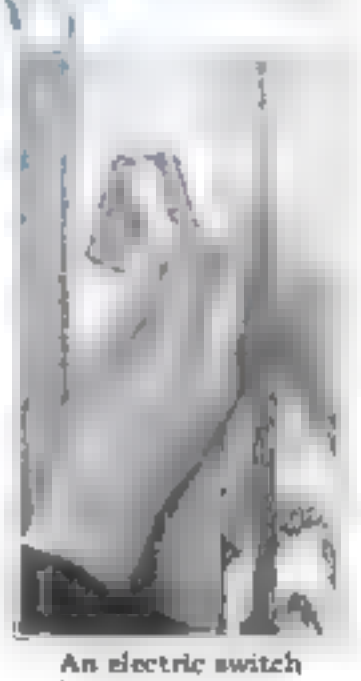
The rubber band is held by a hook made of strong wire at one end, and the bearing for the propeller is also made of a strong piece of wire. These wire supports should be placed in the block so that the balance will not be destroyed. They must be mounted exactly the same distance from each side. The propeller used is of the type employed on model airplanes.


The boy should tie a thread to this toy so that he may pull it back after the propeller has stopped

Domestic Usefulness of an Old Auto Switch

OLD automobiles have lived their usefulness, the car should not be thrown away.

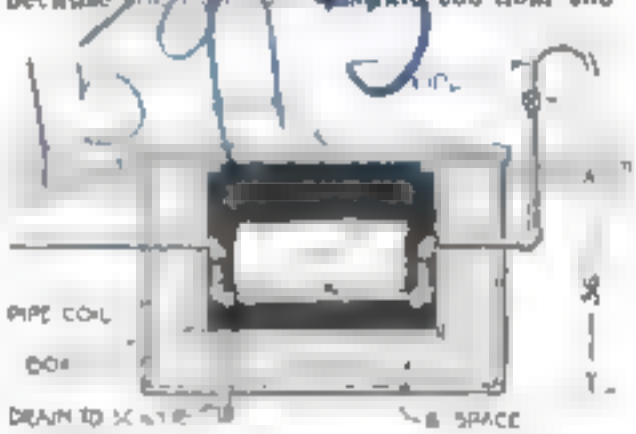
If your house is wired for electric light, some of these switches may be used to advantage for controlling the electric-light connections in various parts of the house. There are many other uses that will suggest themselves to the amateur home electrician.


An electric switch has many uses

The switch may also be used on an electric toaster, percolator, or an electric iron.

Ice Bills Reduced by a Submerged Cooler

AT a local ball park drinking-water was supplied from a tap from a city main, but it was always too warm to be palatable because the pipe ran too near the surface of the ground. The water had to be iced before it could be used.



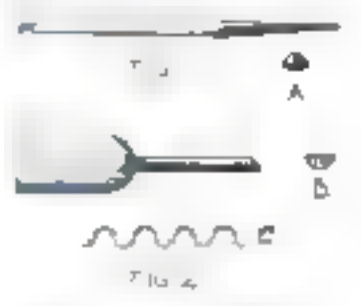
This shows how the water in public drinking-fountains may be cooled during the hot season at a small expense

The system illustrated here was finally hit upon and gave satisfaction. It saved 50 per cent of the previous ice bills.

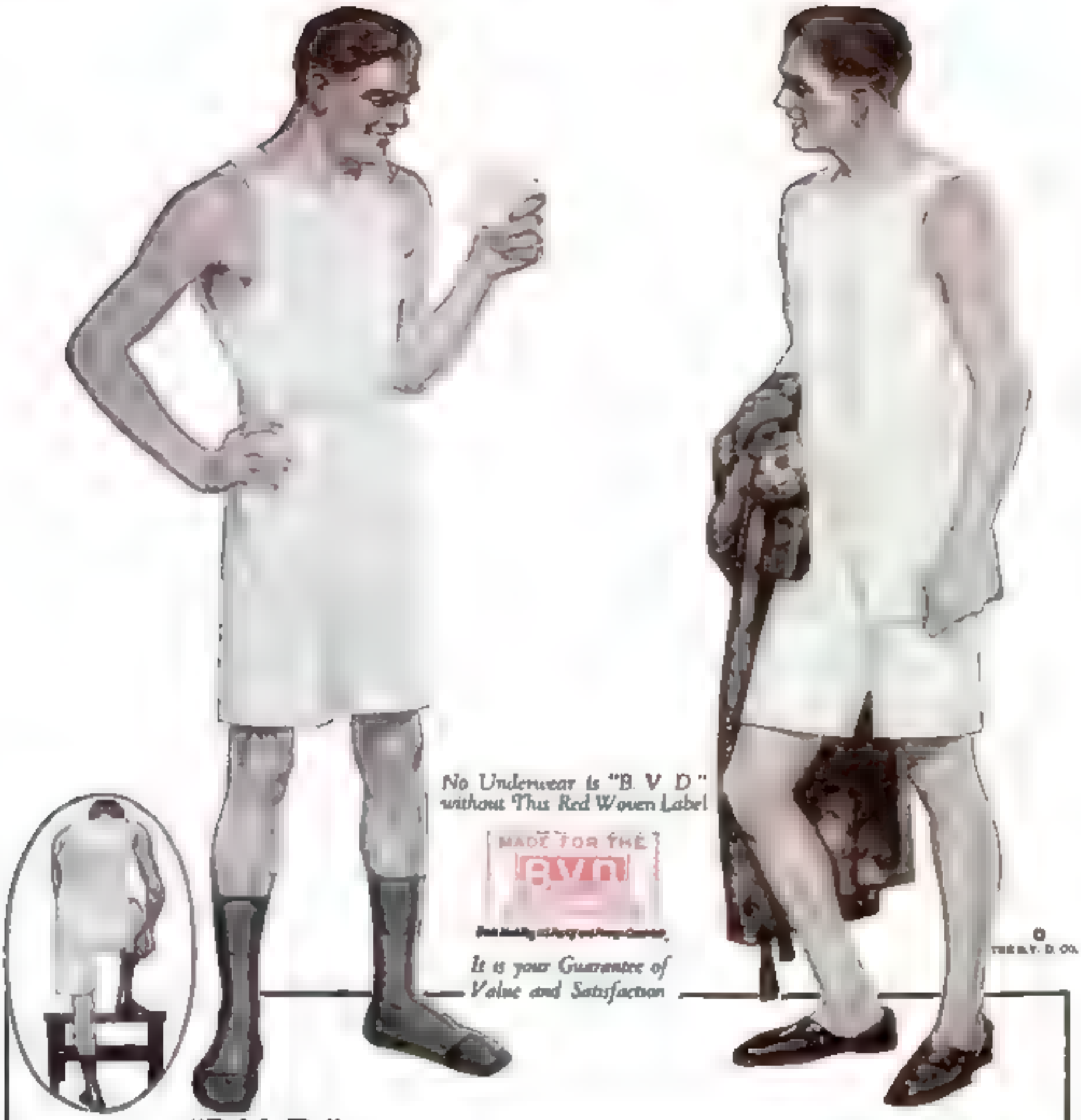
A Saddler's Needle as an Engraving-Tool

HAVING consented to cut a friend's initials on the handles of his umbrellas, I found that I had no engraving-tool. Pressing a saddler's or bayonet needle into service, I improvised an engraving-tool as illustrated here. I drove the eye end of the needle into the short wooden handle, then cut off the point of the needle and ground it as shown at *K*.

The first cut should be made with a twisting motion, leaving a zigzag mark as shown in *C*. The cuts are later smoothed out.—J. M. KANE.



How a saddler's needle became an engraving-tool



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Wear Rubber Cuffs in Handling Meat

HOUSEKEEPERS, butchers, or tradesmen handling goods that are liable to soil their linen and clothing will find it practical to wear protecting cuffs. A small section of an inner tube may be used as

Anybody that has to do messy work may protect his shirt sleeves by using cuffs made from an old inner tube

shown in the illustration. If necessary, a longer piece may be employed to form an overlapping ring to the elbow or beyond.

These rubber cuffs can be kept clean by washing them from time to time with soap and water. C. A. BLACK, Jr.

An Old-Time Brace and Its Construction

FOUND among the interesting relics of Revolutionary days resurrected from the trash-pile in the attic of an old building was a brace that had evidently been made by a blacksmith for use in his own shop. Its form and construction are clearly shown in the illustration.

Observe the clever construction of the turnrest

Of particular interest is the ingenious method by which the maker solved the problem of providing the brace with a swiveling handrest. The illustration needs no further explanation. The shank of the drill or auger is fitted into a square hole of the tool arm of the brace.

How to Make a Bow-Gun without a Bow

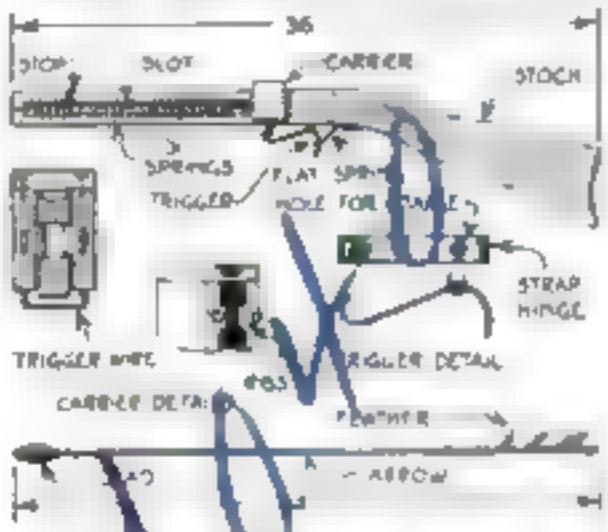
THE bow-gun without a bow described here will shoot arrows a considerable distance. It is easily constructed and requires only materials found about any home work-bench.

First to be made is the gun-stock. This is whittled or sawed out of a piece of soft, straight-grained wood 36 in. long and about 1 in. thick. The barrel should be left about 4 in. wide and a groove or slot parallel to the edges, should then be cut through the center and for nearly the entire length of the barrel. Leave 3 or 4 in. of solid wood at the end. Groove the top edge with a gouge.

The carrier, or that part which propels the arrow, is illustrated in detail. This consists of two square pieces of wood about 4 in. each way. Each should have a rib, intended to travel in the gun-groove. A third piece of wood is screwed across the tops of the two sides. Insert a screw-eye in the front edge of each side piece of the carrier. On their under side the side pieces of the carrier should be connected with a U-shaped piece of stiff wire. The carrier should slide back and forth easily upon the barrel without coming off.

Next, insert a screw-eye on each side of the barrel at the end and connect these with the screw-eyes on the carrier by stiff springs from curtain-rollers. The shorter these springs are, the farther they will force the arrow.

The trigger, shown in detail, is made from a common strap hinge of suitable size. Curve one end to form the finger-hold. The other, long end should be bent to form at its end. Bolts on each side of the hinge



The distance to which the weighted arrow can be shot depends on the strength of the spring

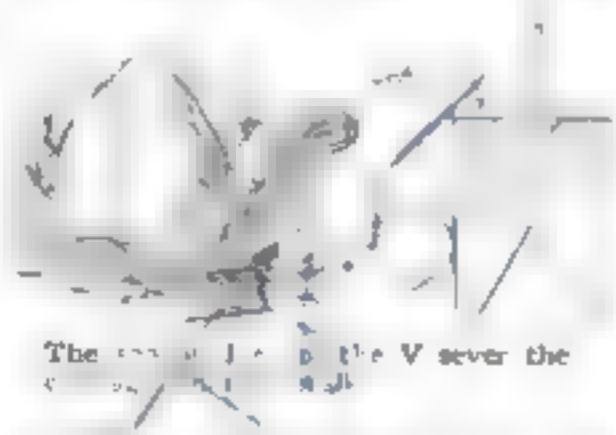
will allow a staple to hold the hinge on the under side of the gun-stock.

Make the arrows about 2 ft. long rounding and smoothing them well so they will slide easily in the groove. Wind lead around one end and tie a feather at the other. The best balance will have to be determined by experiment.

The gun is operated by pulling back on the carrier until the latch hooks behind the trigger. Insert the arrow in front of the carrier, put the gun to the shoulder and pull the trigger. This releases the carrier, which shoots forward by the pull of the springs, and drives the arrow to the desired target.—L. B. ROBBINS

A Cabbage-Cutter Made from a Spade

A VERY useful cabbage-cutter can be made from an old spade. In the first place, a wedge-shaped portion is cut from



The [illegible] of the V sever the [illegible]

the [illegible] as is shown in the picture. The edges of [illegible] then sharpened with a file.

In using the cutter the open part is pressed against the stump of the cabbage. When this is cut through, the cabbage falls on the spade and can then be tossed into a cart.—S. LEONARD BASTIS

Real Butterflies Beautify the Serving-Tray

IT is very easy to make an ornamental glass-covered serving-tray. The only requirements are an ordinary plain glass-covered serving-board, some absorbent cotton, some dried grasses or silk from milkweed pods, and a few butterflies.

When the butterflies are caught, they are placed in the fumes of ether or any

Arranging the material that goes into the making of the decorative tray

other medium that quickly kills them. As soon as possible after they have been caught they should be spread on the spreading-board so that all parts lie symmetrically. Here they remain for one or two weeks until they are perfectly dry.

When the butterflies are ready for use, take the tray, remove the back and place the cardboard backing upon the table. On the cardboard spread out a thick layer of absorbent cotton as evenly as possible and cover the cotton with a piece of silk. On this silk place a few grasses or milkweed seeds ornamentally. Then take the butterflies from the spreading-board, carefully remove the pins, and lay them on the silk as desired.

When this has been accomplished to the satisfaction of the worker, take the glass

The completed glass-covered tray is not only useful but very ornamental

and carefully and gently lower it upon the butterfly-covered silk. Lift up the entire design and place it in the frame. Gently but firmly press it down so that the back fits snugly into the grooves of the frame and rests in place. For greater strength it is advisable to back up the cardboard with a thin piece of wood covering the entire frame. E. RADE.

To Lubricate Fine Watches and Chronometers

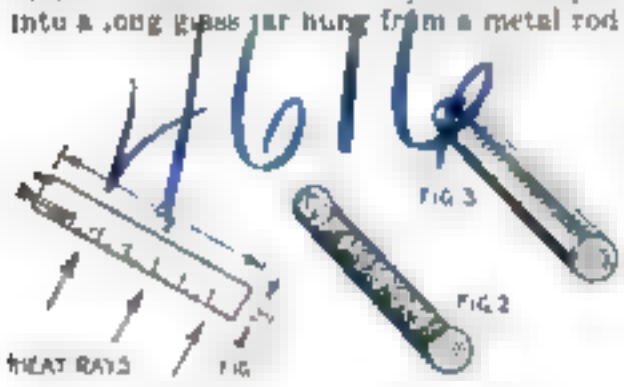
OIL suitable for lubricating the bearings of fine watches and chronometers has heretofore been obtained almost exclusively from the maxillary fat of the porpoise. The cost of this lubricant is about $250 a gallon, which is almost prohibitive, notwithstanding the fact that only minute quantities of the oil are used.

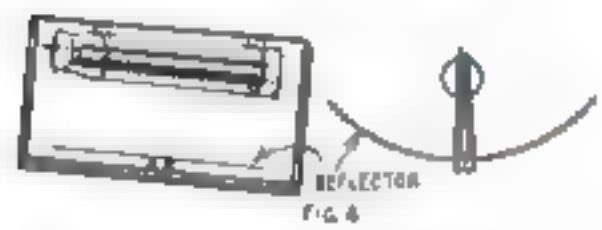
Recently a thoroughly satisfactory oil for this purpose has been obtained from petroleum by a new process and its cost is insignificant compared with that of the porpoise oil.

A Multiple-Cup-Boiler Solar Engine

THE illustration below shows a boiler for generating steam enough to run a small turbine. A number of semicircular partitions or bulkheads are placed along the bottom, dividing it into a number of compartments or cups. With these, the boiler may be tipped at a considerable angle, yet expose a maximum amount of water to the heat

In building the boiler, a cylinder of sheet metal is cut in two, and ends and bulkheads fitted into one half, then the second half is soldered to this. The boiler is put into a long glass jar hung from a metal rod





This apparatus demonstrates the heat-producing powers of the rays of the sun

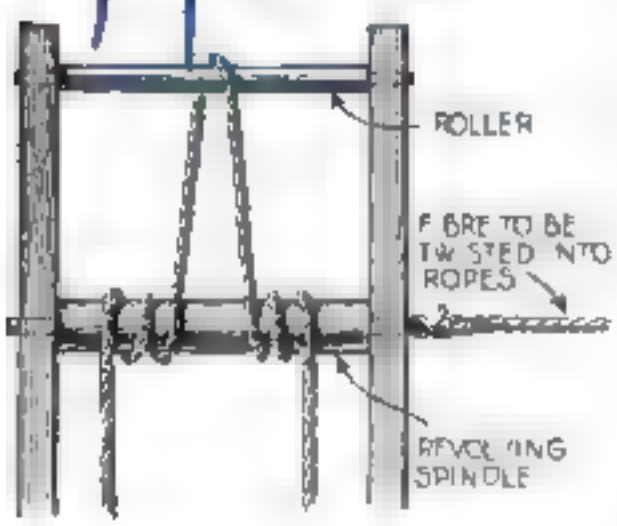
and over a parabolic reflector. The illustration gives a suggested design for the toy turbine to be run by this boiler

After a run, the water remaining in the boiler should be poured out. It may then be refilled with the exact required quantity.—EDWARD R. SMITH.

How Rope-Twisting Is Done in India

ROPE-TWISTING is one of the industries of India, where jute is grown for that purpose on a large scale. [illegible] modern machinery is used in this industry, but the results are quite satisfactory.

The illustration shows the ingenious apparatus employed for giving the rope a



Alternately pulling the two ends of the rope coiled around the spindle gives a continuous rotating motion to it

continuous twisting motion by alternately pulling the two ends of the rope coiled around the twisting spindle. It is a curious application of well known mechanical principles.

Paddle Your Own Canoe

By E. Bade

A STRONG, serviceable, inexpensive canoe can be easily built by any one who is handy with his tools.

The graceful lines of the canoe are shown here

The first matter to be decided is the length desired. This will depend entirely upon the number of persons the canoe is to carry. For two persons a 12-ft. boat is sufficient. The determined length of the finished craft is laid out in the keelson, which should consist of a [illegible] by 1¾ in. piece of cypress. To this are attached the bow and stern pieces, which are sawed out of a cypress board ¾ in. in thickness. These pieces should be uniformly curved and are attached to the keelson with brass screws as soon as cut.

Two bulkheads are then cut out and attached to the end of the keel and to the bow and stern pieces. Then the center rib or centerpiece is made from three pieces of wood mortised together. This is also screwed to the keelson in the exact center of the boat. Two more ribs must be made in a similar manner and attached halfway between bulkhead and center rib.

Now the rib-bands or strips to which the canvas is attached, are placed in water and saturated for one or two days so that they become soft. These consist of ⅜ in. by 1 to 1½ in. pieces, about 14 to 15 ft. long for a 12-foot canoe; for a larger canoe longer pieces must of course be used. When these pieces have become soft and can be bent easily, they are attached to the stern piece, bent to the bulkhead, then around the ribs, and to the bow piece. Care must be taken while bending and attaching the pieces with screws that the edges do not split off. After the strips have been attached (eight will be needed), the overlapping ends are cut off flush with the bow and stern.

Now the canoe is ready for the canvas. This should be in one piece. Tack the center of the canvas to the keelson, stretch it firmly over the center ribs, and tack it in place with copper tacks. Con-

The wet canvas should be tightly stretched over the ribs of the canoe before it is tacked down with copper tacks

Putting in the rib-bands, the last operation before the canvas covering is put in its place

tinue to tack the canvas in place along the ribs and the gunwale and stretch it as tightly as possible in all directions. If the canvas is heavy and difficult to stretch, wetting will limber it up. All wrinkles must be removed, and the canvas should fit tightly over every part of the frame.

When the canvas is in place, a keel piece is placed upon the keelson on the outer part of the canvas. This is a piece of ¾ by 1¾ in., and it is screwed directly to the keelson through the canvas. It must run the entire length of the boat.

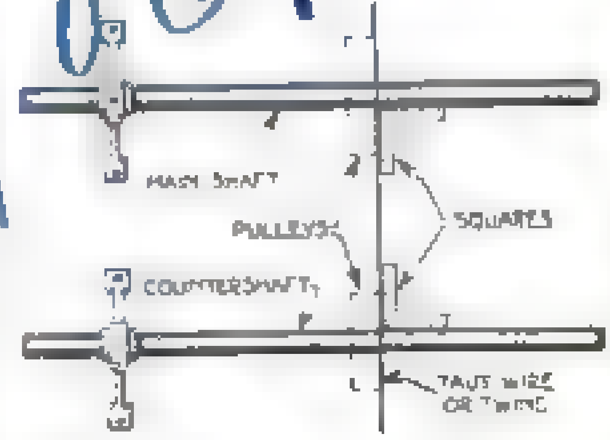
When the canvas is dry, apply a coat of white lead rich in oil. The second coat consists of a thicker mixture, while the final coat should be quite heavy, but still run freely off the brush.

How to Aline Shafting Pulleys

WHEN a belt connection is to be made from a pulley on a main shaft to a pulley on a countershaft, great care must be taken that the pulleys are in perfect alinement or otherwise the belt will not remain on the pulleys. A simple yet highly effective method of obtaining accurate alinement is shown in the accompanying illustration.

A large try-square is placed against the main shaft and a string or wire is tied to the shaft and stretched to the other shaft so that it will be in perfect contact with the arm of the square that is at right angle with the shaft.

If the two shafts are parallel, the angle between the wire and the countershaft should always be a right angle. This could be ascertained by the use of try-squares. If the angle is not a right angle, the position of the countershaft should be changed to make it parallel to the main shaft. The pulleys are placed on the two shafts to coincide with the position of the wire.



This illustrates the method of alining pulleys on parallel shaftings by try-square and wire

This method is much more direct and simple than methods requiring complicated measurements.

How to Make Your Own Section Liner

IF you do not possess a section-liner instrument of the rather expensive kind, a perfectly practical one may be quickly improvised for use in connection with a

This section liner costs nothing and is as serviceable as an expensive one

draftsman's angle (either 30 degrees or 45 degrees) as follows:

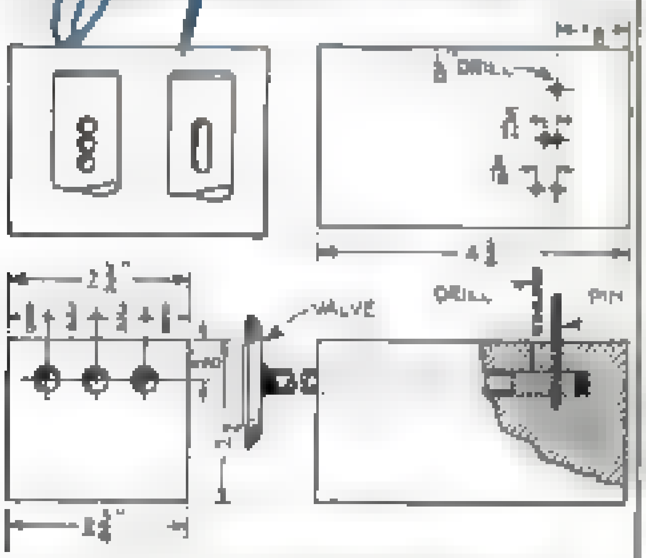
From thick cardboard cut an irregular piece the exact shape of the [illegible] of the angle to be used [illegible] one of the edges at right angles to the T-square a strip equal in [illegible] the spacing desired between the [illegible] lines.

In using the device, hold it as shown in the accompanying drawing and move both the device and the angle along the T-square alternately in the same manner as with all section liners.—EVERETT ROGERS.

A Jig for Accurately Slotting Valve-Stems

TO facilitate the accurate slotting of engine valve-stems, the jig illustrated here was employed in a repair-shop.

The jig consisted essentially of a bar of cast iron, in the form of a square prism. Three holes A were drilled along its length, the diameter and depth of the holes being



With this jig valve-stems may be cut with accuracy

determined by the dimensions of the valve-stem. In addition, five ⅛-in. holes were drilled vertically, their centers being located as indicated in the illustration.

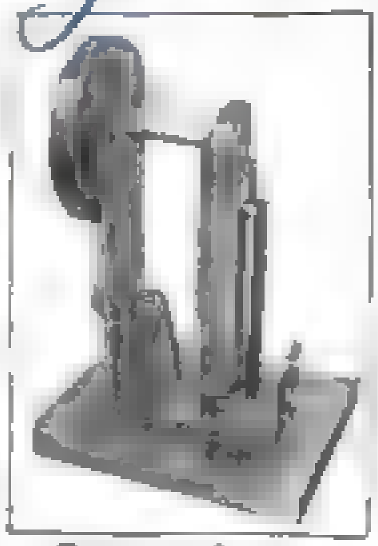
Operation of the jig was as follows: Place the valve in the first hole, and drill first vertical hole. Remove the valve and place it in the second hole, insert a pin to line up with the hole previously drilled, and drill the second hole. Repeat the operation, remove the valve, and with a round file, cut through the three holes drilled.

A Compressed-Air Engine of Cigar-Box Wood

THE flywheel for this compressed-air engine should be made from two disks of cigar-box wood 5 in. in diameter, nailed together with the grain of the wood at right angles. The crank-wheel is made likewise, but is only 2 in. in diameter. Both wheels are held on a wire shaft 4 in. long. A piece of a steel knitting-needle makes a good shaft.

The base is the end of a cigar box, being 5 by 2 in., and the two upright supports are the sides of the box, being 4 by 2 in. One side has to be removed from its original position and nailed in place halfway along the end. A brace 2½ by 2 in. is nailed across the top of the two supports.

The bicycle pump that is used for the cylinder has a ... brass pipe soldered to its lower end with a hole drilled through its side to fit over the hole in the base of the pump. This valve-pipe is 4 in. long. The cylinder rocks back and forth as the crank-wheel turns on its valve-pipe as a pivot, and the manner in which the pipe is held by its two supports is clearly shown. The valve-pipe should be ¾ in. from the base. The pump used was a hand type ¾ in. in diameter and 5 in. long. The upper end of the piston-rod was drilled to take a small nail that makes its bearing upon the crank-wheel as shown.



Boys can learn a great deal from this primitive model

The valve, which allows the air to enter and leave the cylinder at just the right time, is a plunger on a small wire that works back and forth in the valve-pipe. The piston is made by winding cotton thread upon the wire until it just fits inside the pipe. The valve wire is 3 in. long and is pivoted to the lower corner of the valve-rocker triangle. This triangle is 2 in. along the horizontal and 2½ in. along the vertical side. It is pivoted at the corner to a support. A rod connects the outer corner of the triangle with an eccentric pin on the flywheel.

It will be readily seen how the engine runs by compressed air forced into the pipe at the base of the cylinder. The valve is carefully adjusted so that just as the piston starts up, the plunger allows air to enter the cylinder and also cuts off the air just as the piston starts on its downward stroke.—F. E. Brimmer.

How to Etch Your Name on Tools

MECHANICS should learn how to etch their names on tools. A little etching outfit is shown in the illustration. It comprises a bottle of nitric acid, some asphalt varnish, a medicine dropper, a stylus, a piece of chalk, and a small water-color brush. A little paraffin will also be necessary.

The stylus is made of a small piece of doweling with an old phonograph needle in one end. A small hole slightly smaller than the phonograph needle should first be drilled in the doweling so that the needle can be inserted without injuring its point. Another stylus is made with a flat point. The point is made of a small rod filed off flat at one end.

Careful mechanics will mark their tools. This describes a method of etching

When nickel is to be etched a mixture of equal parts of sulphuric and nitric acid should be used. Such a solution is known as aqua regia.

First clean the surface of the metal to be etched, and be sure that it is free from all traces of grease. Now paint over it a thin film of asphalt varnish. Permit this to dry until it is just beyond the tacky stage. Now grind up a little chalk and mix it with the water. Paint this over the black surface with the paint-brush. Allow this to dry. The black surface will be made white and pencil marks can be made upon it.

The design, initials, or name to be etched upon the tool is now sketched out with a pencil. When this is done, the stylus is used to scratch the varnish beneath the pencil marks, exposing the bright metal. Now build up a little wall of paraffin around the initials. With a medicine dropper suck up a little acid and drop it into the letters, forming a little pool. The acid will immediately attack the metal, causing bubbles to rise. When the bubbles cease to rise, suck the acid off with the dropper and replace it with fresh acid. It will be necessary to do this several times before the acid will have a chance to etch a deep letter.

When the worker is satisfied that the letter is etched deep enough, he should wash the tool under the faucet. The asphalt varnish is then scraped off and the tool cleansed with an oily rag to prevent rust. It should be said here that the sulphuric acid will work more rapidly if it is diluted with water. Hydrochloric acid may also be used very effectively.

This method of etching can be applied for other purposes. For instance, if the worker has a disk to cut out of hard-tempered stock, he can apply the asphalt varnish, scratch a circle with a set of dividers, and pour the acid in as before. If the supply of acid is replenished several times, the disk will eventually be eaten out.—Carl Royer.

Imitating Hard Woods Is Not Very Difficult

IT is worth knowing that soft woods, treated with oil stain finished over with two coats of varnish or varnish and wax, can be made to resemble closely light or dark oak, cherry, mahogany, walnut or mission oak. The work does not require any exceptional skill and the result is invariably well worth the effort.

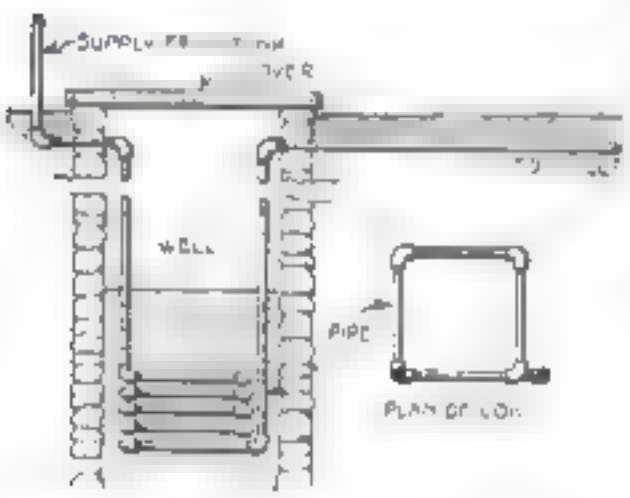
Cooling Drinking-Water on the Farm

WITH the coming of warm weather, the proper cooling of drinking-water on farms and in localities where the water supply is held in elevated tanks, becomes an interesting one

After a few hours under the heat of the sun this water becomes tepid and often unpalatable, even after running through underground pipes. But if you possess an old discarded well or cistern, the problem loses much of its terrors. At a depth of about 20 ft. water in a well retains a temperature of about 45 to 50 degrees, and with greater depth the temperature becomes lower. So, by running the supply of water from the tank into a well of sufficient depth, and leaving it there long enough, it will be cooled to the same temperature.

Make up a coil of pipe of the same size as that used in the supply line for the house. This coil should be as long as practical to give a large cooling surface, but should also be constructed with an eye to letting it down the well without difficulty. Each layer of the coil is in the shape of a square and is composed of four equal lengths of pipe and four elbows. Thread them tightly together, using white lead at all of the joints.

The last elbow of each section should be inclined just a trifle so that the first pipe



The cold water in the well chills the warm drinking water from the elevated tank before it reaches the house

of the next section below can be set in place without bending. At the end of the top section and the end of the lowest section arrange two elbows with their openings pointing upward into which are threaded two pipes of equal length

These pipes must be long enough so that when the coil is lowered to the bottom of the well the tops of the pipes can be connected with the supply and outlets a reasonable distance underground.

Polished Table-Tops Ought to Be Protected

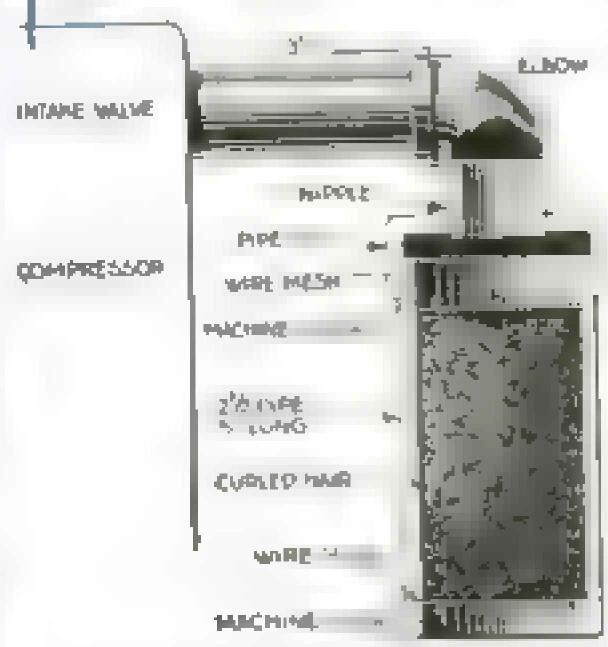
NOTHING will ruin a polished table-top more quickly than placing hot plates and dishes on it without adequate protection by a heat-insulating mat

If you have a table with a highly polished top, it will be wise not to depend on individual mats but to provide a waterproof and heat-proof pad large enough to cover the whole table. These pads placed under the table-cloth protect the polish from injury and mean a considerable saving

To Keep Dust Out of the Air-Compressor

WHEN the efficiency of his air-compressor began to decrease after having been in use for two years, the owner of a gasoline and air station examined the compressor and found the pipe and tank filled with dust. As this dust had obviously been taken in through the intake valve, the proprietor [illegible] to put in an air-filter.

To [illegible] in [illegible] of the compressor he [illegible]-in. pipe, on the [illegible] an elbow. Fastened to [illegible] a 2 [illegible]-in. pipe-cap, drilled [illegible] so as to screw on to the



Filtering the air at the intake of the air-compressor will preserve the efficiency of the machine for a long time

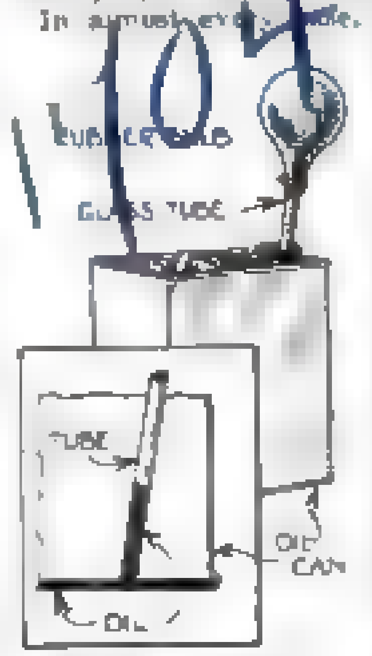
elbow. Into this cap he screwed a 5-in. length of 2½-in. pipe. This pipe had been drilled and threaded to take ten 6-32-in. machine screws, each about ½ in. long.

These machine screws were placed five in a circle around the circumference about ¼ in. from each end. Disks of fine wire mesh were cut to fit snugly the inside of the pipe and were held in the pipe by the protruding machine screws. Between these disks was placed a quantity of curled hair. New hair should be substituted about once every sixty days.—THURON P. FOOTE.

Using a Suction Syringe for Oil

I RUN my motorcycle at no cost to me for lubricating oil, simply by using what other people throw away.

In almost every case, there remains a quantity of oil in an oil-cans, even after the most careful straining.



Enough oil is left in emptied oil-cans to lubricate a motorcycle

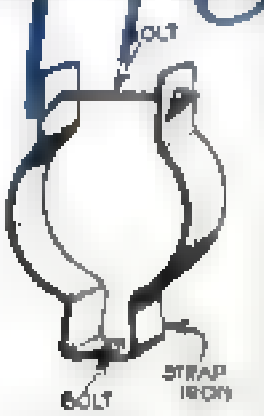
By unscrewing my motor horn bulb and attaching to it a length of engine gage-glass tubing, I recover the remaining oil just as easily as does a syringe take up the ink in fountain-pen filling. Any one can make such a suction syringe in a few minutes.—GEORGE H. HOLDEN

A Holder for Rewinding Motor Stators

A SERVICE company in Massachusetts uses an interesting device to facilitate holding motor stators during rewinding operations. The device consists of a

How the motor frame is temporarily held on the bench during the rewinding operation

flexible metallic holder constructed of a piece of strap iron. The piece of iron is about 28 in. in length and is bent into the shape of a U clamp with its upper ends held in place by adjustable rods and bolts.

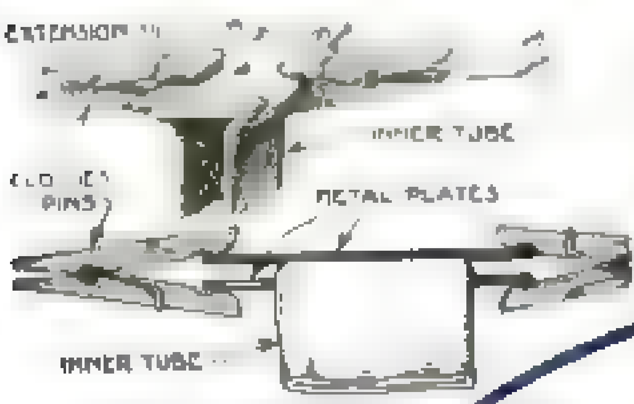


The detail of the holder's construction

The lower end is bolted to the bench. The whole outfit forms a receptacle with adjustability to a wide variety of motor frames ranging from 6 in. to 9 in. in diameter. Its simplicity is its recommendation.—ALLEN P. CHILD.

Spring Clothespins Useful in Patching Tubes

TWO spring type clothespins are of advantage for use in patching inner tubes. Secure the tube by means of these to a stiff piece of metal or board tacked on the edge of the work-bench and the hole to be



Spring clothespins are a useful accessory in the shop for holding inner tubes in position while they are undergoing repairs

covered is held in position for cleaning the surface with sandpaper and holding it securely while the cement is drying.

When the patch is applied, it has a tendency to curl up at the edges unless some weight is placed on top of it. Cut two square sections of thin board or metal, place one under the patch and the other over, apply these clothes-clamps and the tube can be laid aside with the assurance that the patch will stick tightly against the tube. When a tube is punctured while driving, this clamp can be put on and the tube rolled and placed in the toolbox without delay.—G. A. LUERS.

How to Make a Double Socket

TO make your own double socket, secure fiber board not more than 1/16 in. in thickness. Cut this in oval shapes—two of them, making them 2¾ in. in length.

Next cut some soft brass as shown in

The first step is the cutting out of the metal base

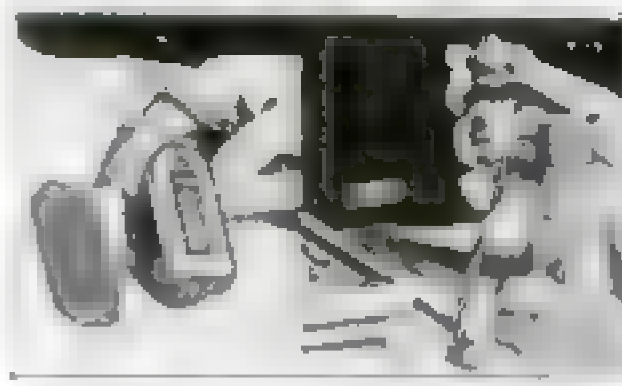
Fig. 1. Cut another piece of brass ¼ in. in width, and bend as in Fig. 2.

In each of the two pieces of fiber cut four rectangular holes ⅛ by ½ in., two at each end. The holes at each end should be ¾ in. apart and the distance between the two groups of holes 15/16 in. Five little brass fasteners that can be flanged at the bottom and the screw portion of an old electric socket complete the necessary equipment, as shown in Fig. 3.

Now fasten the screw socket to one of the fiber boards with the brass fasteners, then place the small brass piece in the center of the fiber so that its crooked end is in the center of the socket, and its curved end projects in the opposite direction. Then fasten the larger brass piece so that the tab at its square end also projects through one of the holes through the fiber board into the socket, and its tab at the rounded end projects in the opposite direction, parallel to the tab on the small brass piece. Now fasten the two fiber board pieces together and flange the fasteners.

One picture shows how an electric light and an electric toaster may be used from one socket. Half of the plug of the toaster is pushed through the two end holes of the fiber, and the screw portion of the plug is then slipped over the metal contacts.

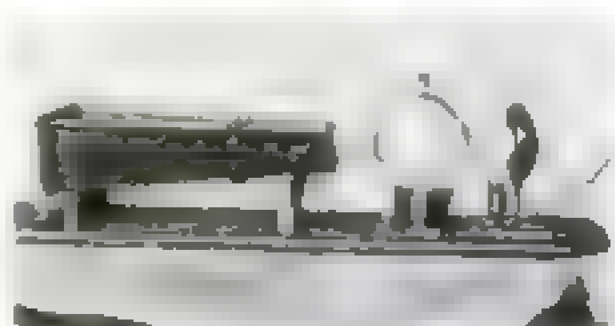
Here the parts are illustrated before they are assembled



To the left the assembled socket with the top removed; to the right the complete socket with a bulb and service wire

Using an Enlarging Camera in Artificial Light

A VEST-POCKET camera of 2¼ in. by 3¼ in. size is one of the greatest companions that one can have. Opportunities present themselves at the most unexpected moments and, when one has a good lens, some remarkable pictures can be procured that are certainly worthy of enlarging. It is out of the question to carry about a camera making a 6 by 7 in. picture when one is engaged in other means of making a livelihood.



Camera, condenser, light and reflector must be accurately aligned for enlargements

The writer is a great believer in the "Take it small and enlarge" slogan, and has been experimenting for one year with an enlarging camera, using artificial light.

The greatest trouble the writer experienced was in getting good illumination. When opal glass or ground glass was used, it took from twenty to twenty-five minutes to get a print on bromide paper. This was a very drawn-out process and required a lot of patience.

After using up an enormous quantity of ground glass, opal glass and electric-light bulbs, the writer used a condenser consisting of a glass bottle with a spherical body. This bottle was filled with water to which were added a few drops of copper-nitrate solution which produced a greenish tint and seemed to greatly increase the actinic value of the light. Behind this globe was placed a 50-watt Edison opal bulb, and back of the light a reflector from an old-style automobile lamp. Bromide prints are now made in from 1½ to 10 minutes. Care must be taken to have camera, condenser, light and reflector all in line, otherwise the prints may be lacking at the corners. The picture will illustrate the arrangement of this apparatus.

For determining the length of exposure required for various negatives, a rack is made on which are placed about six negatives of various density, each negative marked with the time of exposure necessary. All one has to do then is to compare the density of the negatives to be enlarged with those on the rack and expose accordingly.—GEORGE BENDER.

Take Care of Nickeled Automobile Parts

THE owner of an automobile should not be too vigorous in polishing the nickeled parts of his car, otherwise, after a few months, the brass or steel will show through.

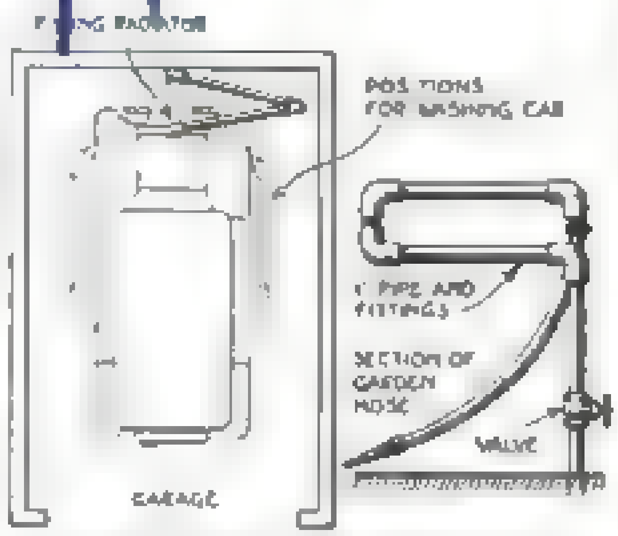
In caring for these parts use only the same polish as is used for silver articles and rub only sparingly. Wiping afterward with an oily rag will prevent tarnishing and preserve the thin nickel coating for a long time.

Parts that are not handled much may be protected from tarnish by coating them with metal lacquer.—G. A. LUERS.

A Swiveled Water-Pipe for Garage Purposes

A SWIVELED pipe connection with the hydrant as is shown in the illustration is of advantage in the garage for filling the radiator and for washing the car. The connection consists of two lengths of pipe about [illegible] in. in diameter, joined by means of four standard elbow fittings and a short coupling. This is attached to the water-main lead brought up about 3 ft. from the floor, with the cutoff valve placed on this pipe. The water-main is usually located in the end of the garage farthest from the entrance.

The swiveled pipe will permit of swinging the end over the filling cap of the radiator



Where much cleaning and washing has to be done, as in the wagon-shed or garage, this swiveled pipe will be very useful

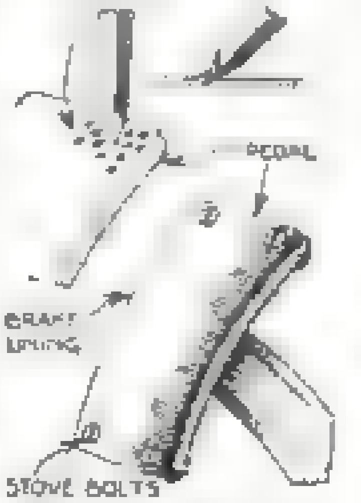
and this is filled without splashing the water over the floor, shoes, hood, etc., by simply turning the water on. A 4-ft. section of garden hose is ample for use with this extension when washing the car. The hose is fitted with a screw connection that may be readily unscrewed

When the Pedal Faces Are Worn Smooth

WHEN the faces of the clutch and brake pedals are worn smooth after a period of usage, an uncertain footing is experienced that is [illegible] shoe sole is slippery [illegible]

Two meth[illegible] for [illegible] ing [illegible] of [illegible] cond[illegible] point [illegible] of roughening [illegible] smooth faces of the pedals. T[illegible] can be done without removing the [illegible]; simply chip spots about ¼ in. apart to make the surface stand out

Another method that is advised is to secure short ends of brake-lining to each of the pedals with small screw-bolts at each corner. The sections of brake-lining provide a good gripping surface for the shoe that makes the operation of the brake and clutch positive in either wet or dry weather.



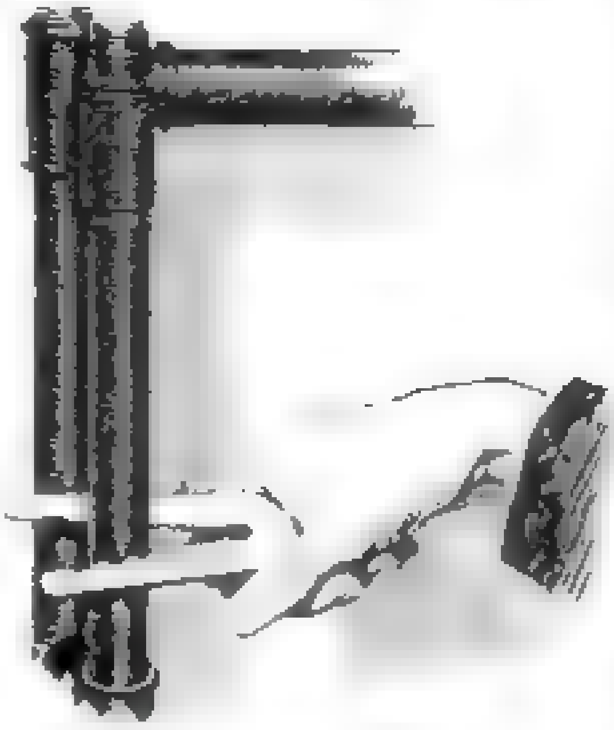
Several methods of rejuvenating old and worn pedal-faces

For Measuring Iron Pipe, Try This Gage

In order to save time and insure accuracy in measuring the sizes of pipes in dark places, difficult of access, the pipe gage described below was made.

It will instantly give the conventional standard sizes of standard wrought-iron pipe from 1/8-in. to 2 1/2-in. inside diameter, these sizes being most commonly used.

In order to make this gage, it is necessary to know the correct outside diameters of pipe from 1/8-in. to 2 1/2-in., and for the benefit of the reader and prospective maker they are given in the following table of equivalents:



Here is clearly illustrated the method of correctly using the gage

1/8 in.	= .40 in.	1 in.	= [illegible]
1/4 in.	= .54 in.	1 1/4 in.	= [illegible]
3/8 in.	= .6 in.	1 1/2 in.	= [illegible]
1/2 in.	= .84 in.	2 in.	= [illegible]
3/4 in.	= 1.05 in.	2 1/2 in.	= [illegible]

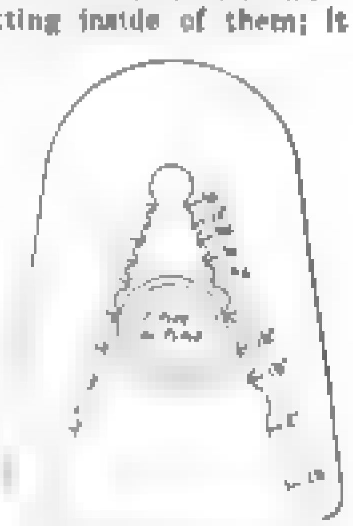
Procure a piece of sheet brass or copper 4 in. wide and 6 [illegible] in. long and 1/16 in. thick. The plan of the gage can be laid off on either the metal or a paper template. First lay out a center line and at a point 1 1/4 in. below the top make an intersecting mark. At the other end of the metal, or 4 1/4 in. from this mark above, measure 1 1/2 in. on each side of the center line and then connect these points with the first point laid off. These two lines are the lines *A* and *B* on the diagram accompanying this article.

Now take a compass or pair of dividers and set them to a diameter of .40 in. or radius of .20 in., which is the outside diameter of 1/8-in. standard pipe. Placing the needle-point on the center line, make a circle so that the circumference coincides exactly with the two lines *A* and *B*. This point can only be found by manipulating the compass until the points required coincide exactly. Now set the compass to diameter of .54 in. or a radius of .27 in. for the 1/4-in. pipe size and, moving slightly down the center line, make another circle in a like manner. Proceed likewise with the rest of the diameters up to the 2 1/2-in. size. See plan of the template herewith.

Draw radii in each of the circles so laid out and perpendicular to the two sides or lines *A* and *B*. These intersections are the points of contact for the pipe when it is placed in the gage for measurement.

When they are laid off properly there will be ten of these points on each leg, one for each pipe size, 1/8 in. up to 2 1/2 in.

Cut out the gage with a fine hacksaw to the shape given in the drawing, being careful to follow the lines *A* and *B* carefully and not cutting inside of them; it would be better to cut a little outside the lines and then smooth down carefully with a file later on. Use a "rat-tail" file to file out the spaces between the measuring points on the legs of the gage.

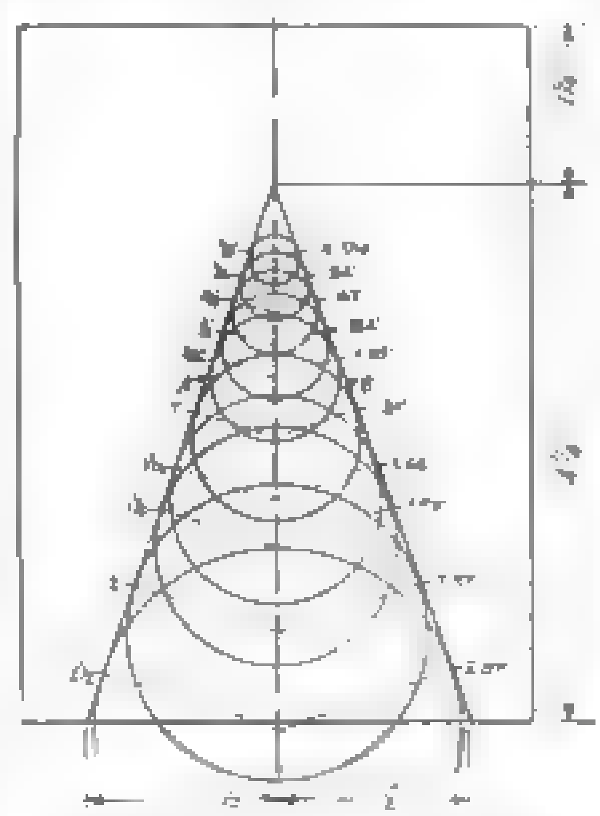


The gage should fit a 1-in. pipe like this

In use, this gage is simply placed over the pipe to be measured and the reading taken at the point where the pipe fits.

Numbers corresponding to the usual pipe sizes 1/8 in. to 2 1/2 in. should be punched or stamped with steel letters or number dies on the sides of the gage.

If it is preferred, the markings and numbers may be etched in the metal with nitric or hydrochloric acid and the etched parts filled in with black varnish or blackened with chemical stain.—H. F. DARRIELL.



This diagram shows how to mark the gage before the filing of the notches

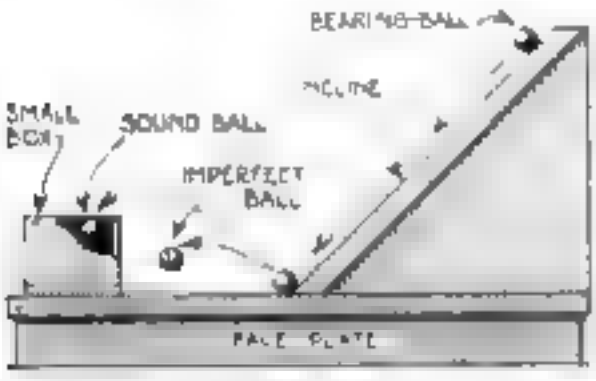
Use Old Tire Rubber for Insulating

While working on an electric line running alongside of a road, the writer experienced considerable trouble by leakage on the high tension wires. Finding an old tire on the road, suggested to him the idea of using parts of the rubber for insulating purposes. It proved successful and by employing pieces of the old tire for insulating the insulators the leaks along the line were stopped.—J. G. SIMPSON.

Leakage prevented on wires by tire rubber

Renew All the Balls When Some Are Broken

WHEN a broken ball is found in a ball-bearing the frequent practice is to substitute one new ball for the fractured one. This is an incorrect practice and the result is that the new ball, which will be several thousandths of an inch larger than



Sound bearing balls will bounce into the box, defective ones will fall short

those adjacent to it in the bearing, will carry practically all of the load.

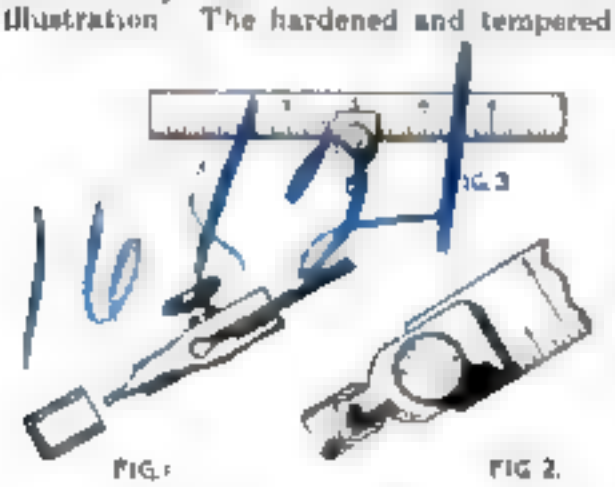
Either the excess load will cause the larger ball to cut the seats of the [illegible] always or the ball will be cracked, due to the overload.

Renew the entire number of balls to [illegible] assurance from more serious repairs. The balls are far less expensive than the races and it is therefore economy to discard all [illegible] balls, for as one can be secured by testing with micrometers for the exact size.

A test of steel balls consists of dropping them on a faceplate. A ball with a hardening crack will rebound but little, if at all. To determine more accurately the hardness of the individual balls, roll them down a fixed incline to strike a faceplate, setting a small box a distance from the end of the incline for the balls to rebound and fall into. Any ball that fails to bound the distance from the end of the incline to the container is either soft or cracked and it is unwise to place it in a race. G. A. LUERS.

Changing a Folding Rule into a Screwdriver

AFTER I had broken a number of pocket rules while trying to use the end for turning screws, I made an attachment for my 6-in. scale that is shown in the illustration. The hardened and tempered



With this attachment your folding rule can be turned into a screwdriver

tool-steel screwdriver point is clamped to the scale by a knurled screw.

To prevent the screwdriver from cutting the pocket I made a guard of a piece of cold rolled steel. When not needed, the attachment can be taken off the scale and carried separately. W. BURR BENNETT.

How to Prevent a Rubber Floater from Swelling

HAVING found cork unsatisfactory as material for a floater in the flush-box of a toilet, I decided to use rubber. I found that the rubber ball, being constantly submerged, would swell at least ½ in., causing it to strike the overflow pipe which in turn prevented proper seating.

By placing a small copper band around the ball as indicated in the illustration, I prevented the swelling of the ball and it proved satisfactory for several years.—ERNEST OPHELDT

The copper band prevents the ball from swelling

Spirit-Level Insures an Even Saw-Cut

FOR a guide in the even cutting of small but important work, such as dovetailing and the like, fit your saw with a spirit level.

An ordinary glass spirit level, enclosed in an odd length of suitably sized tubing, is all that is needed.

At each end of the pipe, cut the tube [illegible] one side, then cut

When horizontal cuts have to be made, a spirit level is a great help

halfway across, some ⅛ in. from the ends, so that when opened they form the lugs, as shown.

If the accessory is to be a permanent fixture, drill each of the lugs, and the back stay of the saw, to take a rivet or small bolt.—GEORGE H. HOLDEN

Protect the Young Plants Against Cutworms

DURING the spring and early summer the cutworms cause great damage in gardens and on truck farms. They love the tender plants and feast on them wherever they can find them.

The picture illustrates a method of protecting your plants from cutworms by a paper barricade. A piece of paper is rolled [illegible] or cuff. The overlapping [illegible] are fastened together [illegible]. Then a 3-in. rill [illegible] around the plant, the paper cylinder is placed in the circular hole, and the soil is replaced. This paper barricade will effectively protect the plants, provided, of course, that it is put in position early enough.—E. BADE.

Cutworms cannot climb this barrier

Repairing a Plane Having a Broken Set-Screw

SMALL iron planes of the class shown in the cut, are commonly rendered useless by the wearing out of the thread of the cast-iron set-screw long before the cutter is worn out. A new set-screw may be inserted in the following manner. Remove the curved clamping cap from the plane, place the point of a ... in. twist drill at the threaded hole and drill clear through the iron. Obtain a ..., by ... round-head stove-bolt with a nut. Make a sheet-metal tongue of the shape shown in the small cut and solder the nut ...

It will be seen that a right angle bend is made in the tongue to assist the solder in

If the set-screw of your plane is broken, the tool may be mended as suggested here

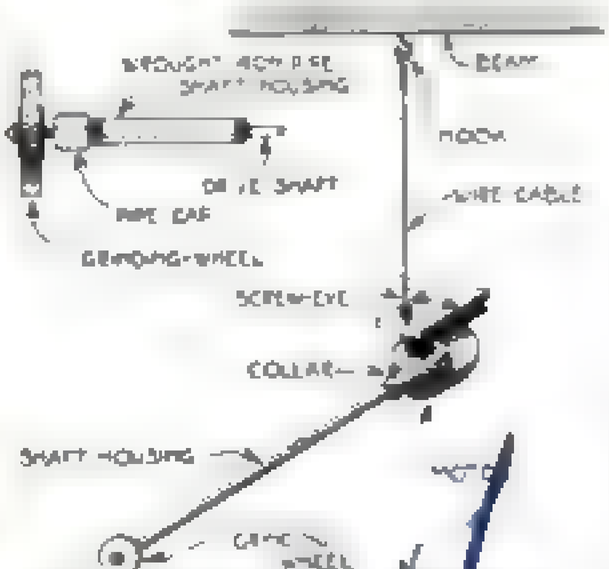
holding the nut. The hole for the bolt is drilled in the tongue before the nut is soldered on.

The tongue hooks into the opening of the curved iron lever and keeps the nut from turning.

The dimensions of the bolt given are for one to be used with a small plane, say a 7-in. plane.—C. H. PATTERSON

A Flexible Grinder without a Flexible Shaft

ELECTRIC grinders with flexible shafting extending to the cutting-wheel are convenient for various sorts of work in the shop or garage. A grinder with some of the flexibility of this type can be constructed



This arrangement gives great flexibility to the grinding-wheel without a flexible shaft

from practically any electric motor with an extended shaft turning in a small supporting wrought-iron pipe.

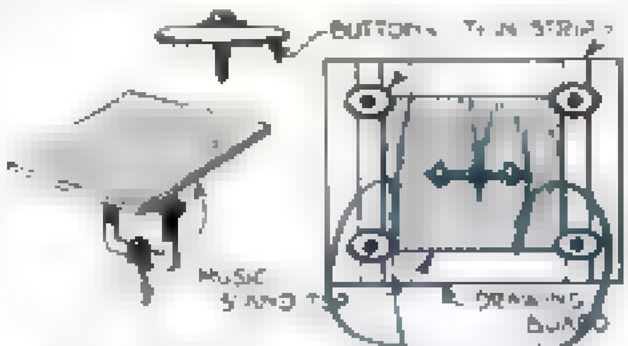
The motor is suspended from the shop ceiling by means of a wire that is hooked to the motor while the shaft extension is free to be moved to the desired grinding job. With this arrangement a motor of any size is serviceable and the pressure from the grinding-wheel is not transmitted to the motor bearings.

Hooks over the several benches in the shop will permit moving the motor to any desired location.—G. A. LUERS.

Buttoning a Drawing-Board to a Music-Stand

HAVE you a light music-stand with a revolving and adjustable top? You may use it as a support to a drawing-board by following the directions here given.

The two parallel buttons on the under side of the drawing-board are placed so



Four turn-buttons on the under side of your drawing board will make a drawing table of your music stand

that they fit tightly against the two opposite sides of the music-stand top. Four buttons are fastened to the battens by means of wood screws and washers so as to engage the four corners of the supporting top of the stand and hold the drawing-board in place.

If the battens should not be thick enough for the top of the music-stand they can be made higher by placing thin strips of wood or pasteboard under them.

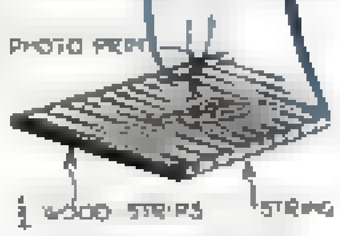
How to Make a Hot-Water Bag from a Tube

IF you have an old inner tube for which you have no other use, you may take part of it for making a hot-water bag. A small hose-nozzle with a tight fitting screw cap is cemented into an opening cut in the tube. The ends of the bag are closed by cementing them. Such bags are always useful and it will be found advantageous to convert several pieces of the tube into hot-water bags in order to be prepared for emergencies.—C. A. BLACK.

Hot-water bags are easily made from old inner tubes

A Superior Photo-Print Drying-Frame

WISHING to dry some photographic prints more rapidly than could be done by drying them on cheesecloth, I constructed a frame for the purpose which gave very good results, allowing the prints to dry well and at the desired speed because of a circulation of air superior to that obtained when drying on cheesecloth.



Prints dry quickly on the network of string stretched over the frame

The frame is made of 1 2/8-in. wood strips and is 2 ft. long and 1 ft. wide, latticed over with twine. The size mentioned was the most suitable for my particular need, but where requirements are different, it may be altered.—H. K. CAPPS.

Why Not Build a Toadstool in the Garden?

W[illegible]

This giant toadstool, fashioned by human hands, lends an oddly picturesque touch to the garden

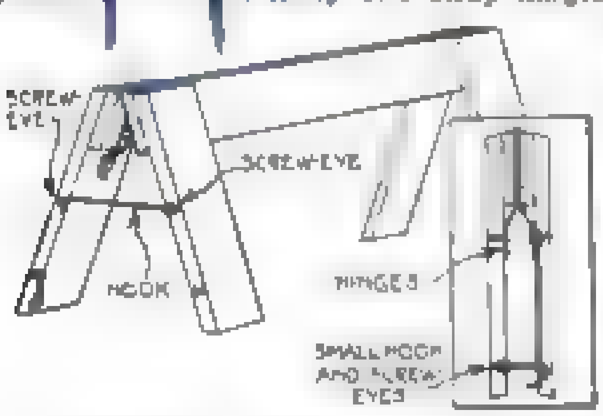
covered bark, preferably the grayish bark of the white birch.

If the top of the giant toadstool is large enough, it will serve as a shelter against sun or rain.—FELIX J. KOCH

Folding Trestle Jacks for Paperhanger or Builder

ONE form of trestle that the writer observed a paperhanger using recently, is of special advantage for the reason that it folds and is readily transported in a small [illegible].

It consisted of two half-trestle jacks joined at the center by two strap hinges



Paperhangers will find this folding trestle strong and easily carried

and held open by means of a screw-eye and bent rod catch.

The construction of this trestle is simple. Hinges of practically any size can be used, and when folded these can be readily piled up upon each other, occupying very little room. Inasmuch as the trestle can be made any height desired, the idea would be of equal use for the builder. Similarly in halls or places where public suppers are held, these trestles would serve as supports for the table-tops and could be conveniently stored in closets when they were not in use.—G. A. LUERS.

Fitting a New Top on a Steel Rod Tip

WHEN the tip of a wooden rod breaks, it is not difficult to whittle it down and put on a new tip. When a steel rod breaks at the tip, it means a nice job of

Three stages of mending the tip of a steel fishing rod are here illustrated

soldering and guarding against melting one of the guides, should the rod get too hot.

The method I used was to stuff paper in the joint to keep the tip in position, wiring the guide to prevent its coming off.

After successfully soldering the tip in, I removed the wire clamps that held the guide.—JAMES M. KANE.

Simultaneously Releasing Two Bolts of a Trapdoor

IN the accompanying illustration a method is shown [illegible] simultaneously releasing the two bolts [illegible] door so as [illegible] on its [illegible] that if [illegible] gallows in Bucks

Pull the rope, and the bolts, simultaneously released, will let the trap-door fall

County, Pennsylvania. The lever that pulls back the two bolts resting on cleats in the frame of the door is operated by a rope attached to its free end.

Cotter-Pin Holes Found without Loss of Time

TO locate cotter-pin [illegible] quickly, punch a small hole on the end of the bolt just over each end of the cotter-hole so that when the holes are hidden from sight when drawing up the machine parts, the punch marks on the end of the bolt will show the direction, and the cotter-pin can be fitted without loss of time.

Mark the end of the bolt to show the place for the cotter-pin

To Put a Smooth Finish on Aluminum

WHOEVER tries to put a good finish on the surface of aluminum [illegible] very much disappointed with the result. The writer offers the suggestion, feeling that it will be of help.

He employed an ordinary block plane used in the regular manner just as if a surface of wood were to be planed. The secret

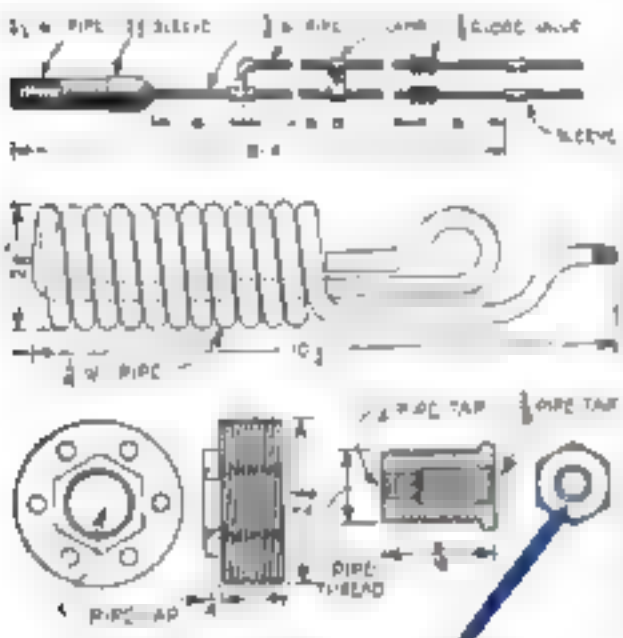
With an old block plane and some kerosene, you can give a smooth finish to aluminum

is to use kerosene as a lubricant. Plenty of the oil is applied and the plane will work nicely. Of course an old plane should be employed for this work as it does not improve the blade.—CARL ROYER.

New Type of Oil-Heater for Metal Work

THE oil-heater described here was designed for use in a railway car-shop.

Oil and air are admitted through separate pipes that join a few inches from the



Details and dimensions of the oil-heater described are shown here

burner. The flow of air and oil is regulated by two ¼-in. globe valves.

The burner itself is a tube into one end of which a ⅛-in. tube carrying the oil and air is threaded. At the base of the tube a number of air holes are provided. Inside of the burner tube a narrow tube forms a coil shown in detail in one of the illustrations. As will be seen, the flames of the burning oil heat this coil and hence increase the efficiency of the burner.

By means of flexible connections the position of the burner may be changed as necessary and the flame may be directed to any point desired.—JOSEPH K. LONG.

Providing a Safe Place for the Bicycles

SHOWN below is a rack that [illegible]

This shows a safe and reliable method of parking a number of bicycles in the garage

well. The pipes are placed 2 ft. apart, leaving enough space to prevent the bicycles, resting against the uprights, from becoming scratched or otherwise injured while putting them in or while taking them out.—F. Reschke

Emery-Cloth a Substitute for Oilstone

A PASSABLE oilstone in emergencies is that made with a piece of fine emery-cloth and a few drops of machine-oil.

Lay the strip of emery-cloth on a flat surface, pour on the oil, and rub it over the surface with the finger. Allow the oil to penetrate well before using.

If you have no oil stone, emery-cloth will do

Finding myself without an oilstone recently I employed this makeshift and found it satisfactory.

It is not as economical as the real accessory, of course In case of necessity however, it is not a bad substitute.—George H. Holden

New Uses for the Old Family Nutcracker

EVERY well regulated family possesses at least one nutcracker, usually slumbering in a kitchen drawer and resurrected only during the nut season.

The old nutcracker however is not quite so limited in its usefulness as people seem to

When nuts are not in season, the old nutcracker may be used as a wrench for pipes or nuts

think. It can be used to advantage as a small pipe-wrench or for tightening nuts, bolts, gas-jets, etc. The picture illustrates the use of a nutcracker as a nut-wrench.—W. A. Jackson

To Make an Underground Telegraph Set

THIS little equipment can be used to carry on communication without wires over a distance of 20 or 30 ft., depending upon the power of the induction coil used. It will serve for all practical purposes up to the distance mentioned.

Four tin or galvanized-iron plates about 2 ft. square are required. Brass or copper plates would be better but cost much more. A brass rod is soldered to each one of these plates and they are then buried, occupying the positions shown in Fig. 1. If a 1-in. spark-coil is used, the two sets of plates may be placed about 30 ft. apart. The plates of each set are placed about 10 ft. apart. They should be buried in soft damp earth about 4 ft. deep. When they are put in place a little salt should be placed over them before the earth is filled in. A bag of charcoal could also be used to

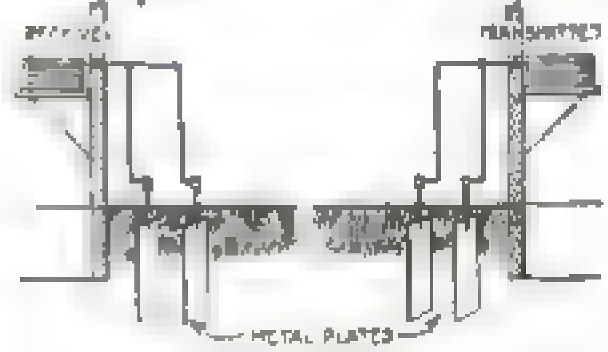


Fig. 1. Here the proper method of placing the metal plates is illustrated

advantage, as a little of this material placed about the plates will make possible a much better earth connection.

The tops of the brass rods that project from the ground should be threaded to receive a nut. Connections are then made with the instruments inside the house.

The receiving apparatus is of the simplest type possible. It is shown in Fig. 2. A telephone inductance coil used in connection with a small telephone receiver comprises the receiving outfit. The required connections are shown. Every connection should be made as well as possible because very weak currents are used.

The transmitting set is also shown in Fig. 2. A spark-coil is used. This may be of any size, the more powerful the better,

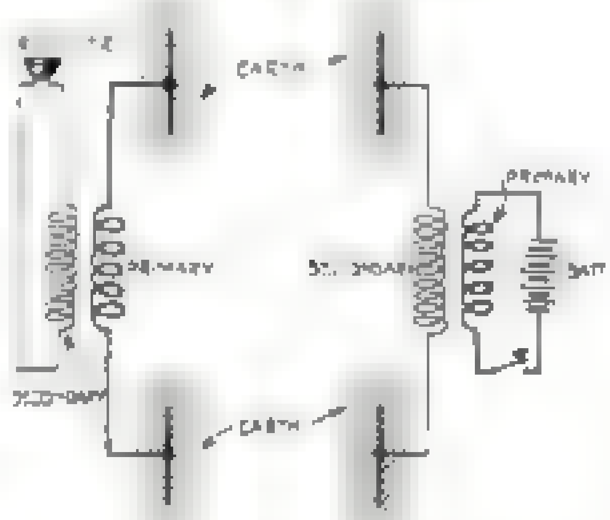


Fig. 2. The wiring shown here is for a telegraph set with a single receiver and a key at the transmitter end

as the signals will be stronger and they may be sent over greater distances. A few dry cells and a key are all that is needed in addition.

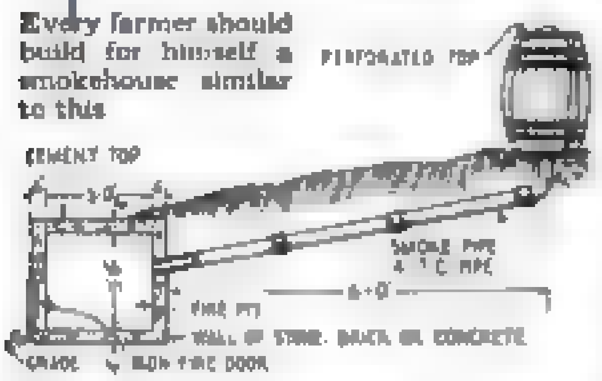
When the key is pressed at the transmitting station, the impulse will be heard in the receiver at the receiving station. If communication is to be carried on, it will be necessary to have a receiver and a transmitter at each end.—W. C. Royer

Build a Smokehouse as an Investment

FARMERS who keep hogs will find that a smokehouse for curing hams, shoulders, and bacons is a profitable investment. A hillside is the best location. The fire-place, a cubical space 3 ft. long, 3 ft. high, and 3 ft. wide, should be made of cement from 4 to 6 in. thick. An iron door should be provided for introducing the fuel. Near the top of the chamber there should be an opening for a 4-in. smoke-pipe leading upward to the smoke-chamber, which on small farms may consist merely of a barrel or hogshead. A perforated cover should be provided for the barrel.

The pipe through which the smoke is conducted from the fire-pit to the curing-house or barrel may be of cement, stoneware or terracotta, with a diameter of approximately 4 or 6 in. The cost of the material is small, and the construction is simple.

For fuel, green hickory, maple, or any hard wood should be used, never pinewood



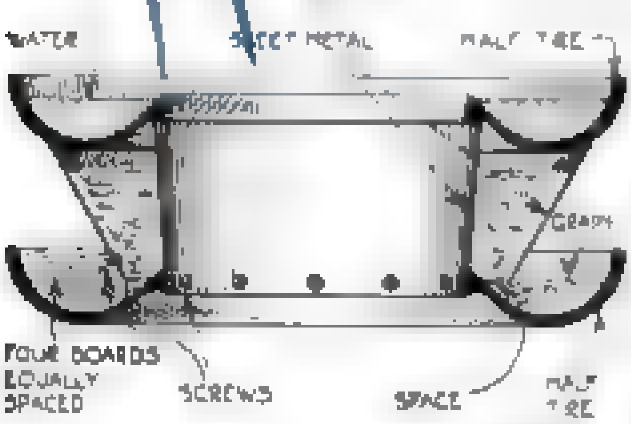
Every farmer should build for himself a smokehouse similar to this

or any wood that contains resin. The meat should be smoked from 36 to 48 hours, unless it is to be kept a long time, when the smoking should be continued much longer

Using an Old Tire in the Chicken-Yard

BELOW is illustrated a [illegible] of utilizing an old automobile [illegible] for making a combination [illegible] and drinking-pan. The tire should be cut in halves all the way around, [illegible] the water-pan the [illegible].

The water-pan is [illegible] it on a cylinder of sheet metal. The feeding-trough forms the lower part. A cone of



With a little trouble one of these feeding- and watering-troughs for chickens may be made from an old tire

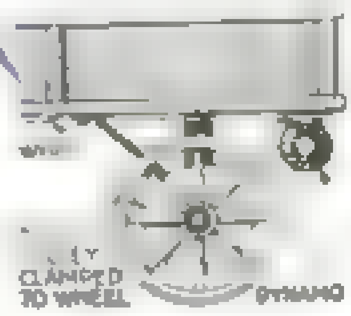
sheet metal is so arranged that between it and the wall of the supporting cylinder of the water-trough there is room for the grain supply for the chickens. The grain trickles through a narrow slit into the feeding-trough, taking the place of the grain in the trough as it is eaten by the chickens. Four wooden boards, cut to fit the curve of the tire, are placed, equally spaced in the trough, to give support to the rubber.—C. E. KLINT.

This Coaster Generates Its Own Light

THE drawing gives a fair idea of the manner in which a coaster is rigged to supply a light when speeding over the sidewalk. A small electric dynamo of 4- or 6-volt capacity is secured by screws to the rear end of the body so that its pulley will

When the coaster is [illegible] it generates its own [illegible]

be in line with a drive [illegible] that you will clamp to one of the rear wheels. This drive pulley should be 6 in. [illegible] and may be sawed from [illegible] with a sharp compass [illegible]. The hole in [illegible] center of this pulley will [illegible] to be sawed out large enough [illegible] it will slip on the hub and four [illegible] should be used to [illegible] spokes of the rear wheel. The [illegible] of this pulley must be [illegible] with [illegible] so [illegible] it will [illegible] the cord [illegible] connecting it with the pulley of the generator.



Showing how the dynamo is hitched to the wheel

On the front of the coaster a small 4- or 6-volt electric lamp should be secured with two screws to correspond with the voltage of the generator. This lamp should be placed a little to the right or left of center so that the steering handle of the coaster will not be right in front of it.—F. E. BRIMMER.

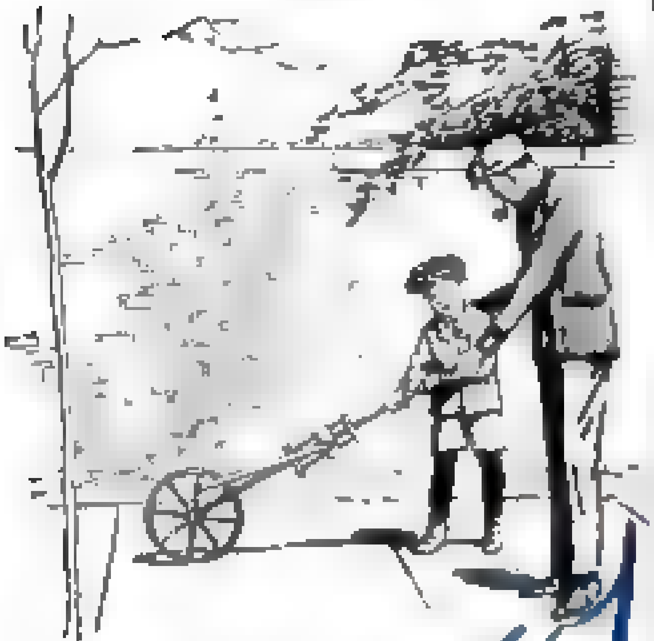
Boot Protector for the Man Who Digs

WHEN digging, the novice often finds that the spade hurts his boot and also does damage to his sole. This may be prevented by the use of a protector.

A piece of wood is cut to fit the instep of the boot. To this is nailed a strip of canvas or burlap, long enough to come up round the sides of the boot. At the ends of the material are fixed tapes by means of which the burlap is tied into position. On the face of the protector (the part that will come in contact with the spade) a piece of tin is nailed.

The wood protects the sole from the edge of the spade

Active Boys Will Like This Toy



Little boys are fond of running and this toy lends additional zest to exercise

If you have a little boy not older than five or six years, you can give him great pleasure and welcome exercise by building a push-wheel like that illustrated here.

The construction of the toy is made so clear by the illustration that no further description is necessary —Emile Le Bel.

Keep Your Golf-Balls Clean and Dry

When the holes in a golf-course are full of water after a rain, a piece of wood, a staple, and a piece of string are all that is needed for making a simple device to keep the "holed" golf-ball clean and dry.

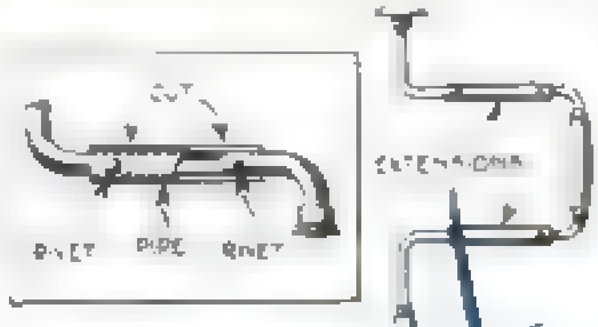
The next time you go to the golf-course, take a small rule with you and measure the diameter of the holes. Mark off a circle on a piece of wood, using half the width of the hole as the radius. The wood can then be sawed round with a hacksaw, following the line made by the compass. It would be well to saw inside the line, as the piece of wood must fit the hole loosely. Drive a small staple into the center of the wood, and attach a string to it.

When your ball is near the hole, and you expect to put it in on the next shot, lower the piece of wood into the hole. The ball can be taken from the hole by pulling out the piece of wood by means of the string.—Arthur Goldenbaum.

Fastidious golfers should carry one of these ball-protectors in their bag for use after a rain

Giving Greater Leverage to the Socket Wrench

WHEN socket wrenches of the brace type are to be used in a shop for tightening or loosening large nuts or bolts, it is sometimes desirable to increase their



By lengthening the arms of the wrench, greater leverage is obtained for turning large nuts

leverage. The illustration shows how such increased leverage was obtained in a repair-shop.

The two parallel arms of the brace were cut as shown and the severed parts united by pieces of iron pipe driven on the severed stumps and held in place by rivets.

For Homemade Toys Use This Wood-Saw

MAKING toys at home I had a great deal of woodcutting to do. As I did not wish to purchase a bandsaw I rigged up an old sewing-machine as shown in the

With the aid of an old sewing-machine stand you can easily rig up a serviceable circular saw

illustration. A block was attached underneath the table to support the spindle screw, which is shown in detail.

A wooden pulley, forced on the spindle, is connected by a belt with the wheel of the sewing machine. The spindle carrying the circular saw was made of part of an automobile axle.—J. H. MOORE.

A Cotter-Pin Extractor from an Old File

BY following the suggestion given in the illustration, a useful cotter-pin extractor may be made from an old file at a trifling cost.

Bend the tang of the file in the form of a hook, then heat the other end of the file to red heat and bend it as shown by blows with a hammer.

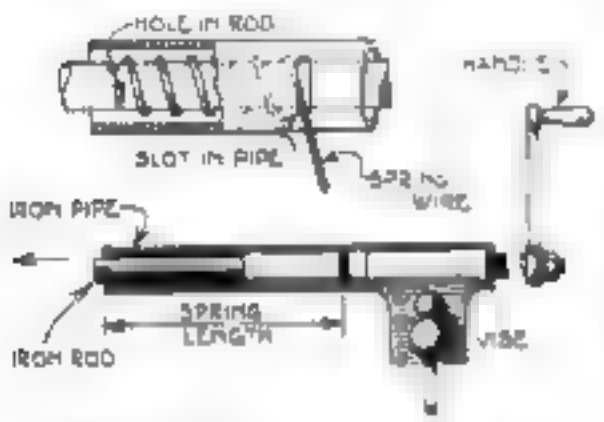
If this tool will not extract a refractory cotter-pin, it will take dynamite to dislodge it

A Coil-Spring Winder of Simple Design

A SPRING winder of simple construction and which will wind a spring the length desired is illustrated below

The outside shell is a piece of smooth bore pipe twice as long as the spring is to be and with an inside diameter equal to the outside diameter of the spring The winding-rod is of solid steel the diameter of which is the inside diameter of the spring In other words, the space between the rod and the inside of the shell is equal to the thickness of the spring wire

Cut a slot in the shell as shown its distance from one end being equal to the intended length of the spring. Then, drill a small hole in the rod to meet the slot



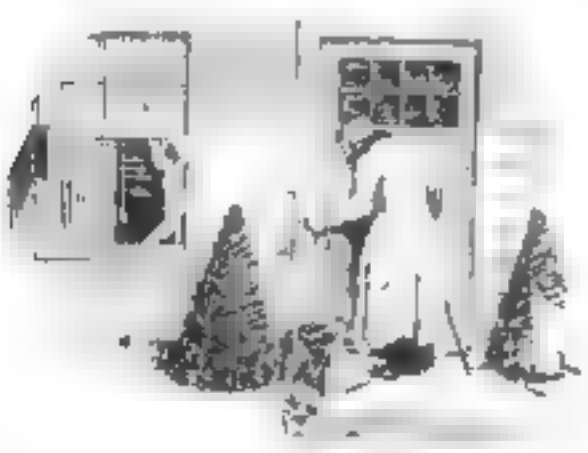
Coil-springs can be wound with speed and precision with a homemade winder

when the rod is inserted in the shell. Provide a thread on the end of the projecting portion of the rod to which may be attached a crank or power pulley

Insert the wire through the slot and into the hole in the rod. Then turn the rod pressing it lightly toward the back of the shell The wire will turn on the rod and be carried back uniformly until the hole in the rod, carrying the wire, emerges from the rear of the shell Then the wire is snipped at both ends and the spring is finished

Using a Mirror to See Who Is at the Door

THE average housewife does not like to open the door to book agents, peddlers or beggars It is often a great convenience to know who is at the door. By the use of a little mirror arranged at an angle of 45



To the busy housewife this telltale mirror is a boon

degrees outside the window, this is made possible in many cases

It all depends where the door is located. If it is at the side of the house, this mirror may be placed outside the kitchen window Any one at the door will be plainly visible in the mirror, while the person on the inside cannot be seen from outside

A Powderless but Not Noiseless Cannon

A SIMPLE, safe, and inexpensive toy cannon is made as follows: Plug one end of a length of gas-pipe and screw a spark-plug either through this plug or near it. On top, near the plugged end, screw in a priming-cup similar to those sometimes used on bulky gasoline engines.

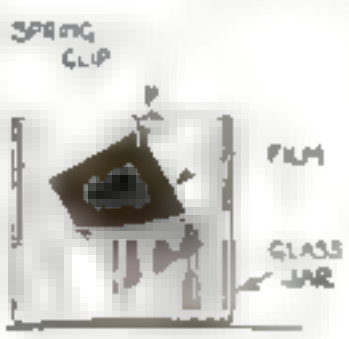
To use the cannon, pour a little gasoline into the barrel (the exact amount will depend on the size of barrel, etc.), close the

This cannon will provide enough noise and excitement for a safe and sane Fourth of July

cup, and ram your load into the muzzle. Now, if the mixture is right, all you have to do is to connect the spark-plug with an induction coil or other source of high potential current, and the shot will be fired.—G. G. STEVENSON.

Slow Developing of Films for Amateurs

VERY good results can be obtained with cut films in plate-holders by the following slow developing method. Use a weak bath and hang the film at the side of a glass jar by means of a spring clip, with the gelatin side out, using, say, two films for a jar.



Try this method for developing cut films

With three jars in a light-tight box, and holding six films, the latter can be put in place in the morning, and four hours later, or at noon, they will be found developed, and can then be put in the fixing-bath, while six more films are placed in the jars to be removed late in the afternoon.

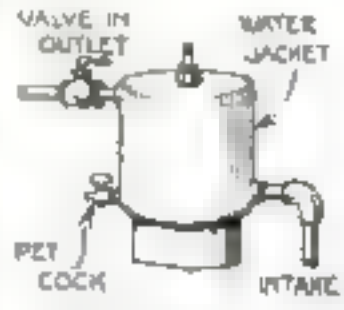
The operation can be repeated during the evening, and as many as 18 films a day can be thus treated.

A diamidophenol developer is used, with 10 per cent bromide. The use of the jars make the films curl, but they will soon resume the flat shape.—FRANCIS P. MANN.

Sediment Cleaned from a Water-Jacket

SOMETIMES motor-boat engines and even stationary engines collect sand or sediment in the water jackets through the circulating pump. In time the cooling of the engine is impeded and serious overheating may result. One way to remove any such collected sediment is as follows.

In the outlet pipe, close to the cylinder head, insert a shut-off valve. Then at the lowest point of the water-jacket drill and tap a hole for a fairly large petcock. During normal running the shut-off valve in the outlet pipe is kept open and the petcock is kept closed.

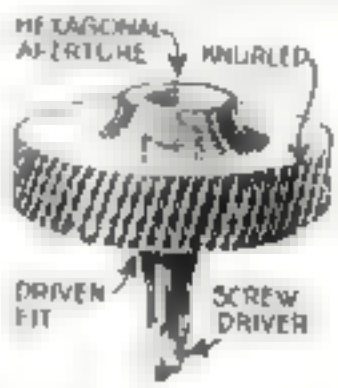


How to flush sediment out of the water-jacket

When suspicious of a deposit of sediment in the water-jacket, start the engine and open the petcock. Then, and not until then, *close* the shut-off valve in the outlet pipe. This *forces* the cooling water around and around in the jacket and thoroughly flushes out any collection that may have occurred. When the water is clear, *open* the shut-off in the outlet first, then shut the petcock. Be careful not to shut the petcock before opening the outlet, otherwise the pump might create sufficient pressure to crack the water-jacket and ruin it.—L. B. ROBBINS.

Use This Special Screwdriver for Close Places

A SCREWDRIVER that was made for the purpose of removing electric contacts from coils and switches under the cowl-board of an automobile is shown in the accompanying illustration. Opposite the screwdriver on the handle is a hexagonal opening for loosening the small terminal nuts.



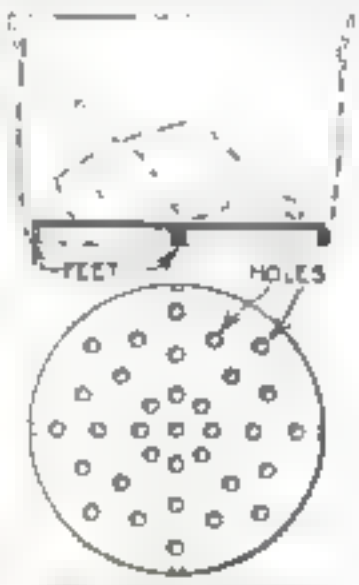
For close-range work this screwdriver is very useful

As is shown, this tool consists of a knurled disk with a short screwdriver blade riveted into the disk. This tool is suitable for places in which the screwdriver with a long handle cannot be used. The knurled face affords a good grip for tightening or loosening a screw.—G. A. LUBKE.

How to Prevent Meat from Being Scorched

WHEN meat has to be boiled for a long time, it often happens that the water boils away and the part of the meat touching the pot is scorched. This can be prevented by the use of the shield illustrated here.

It is simply a disk of tin or agateware with three or four little feet that raise it about ½ in. from the bottom of the pot. The disk should loosely fit the pot, and should have a number of holes for the circulation of the boiling water.



The perforated plate will prevent meat from scorching

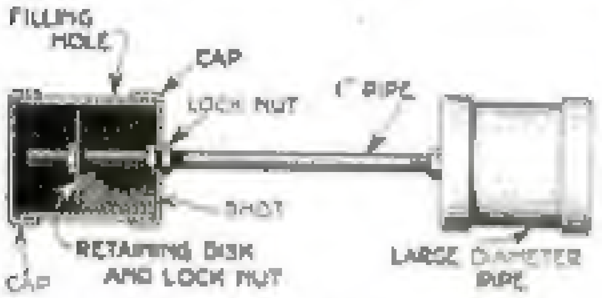

This One
U2WP-KR9-55J2

Heavy Dumb-Bells Built of Pipe Fittings

A DUMB-BELL of variable weight for heavy-weight lifting can be constructed of pipe fittings by any one with a mechanical turn of mind. No dimensions are given, as the length of the handle and size of the bells will vary.

The handle is of 1-in. iron piping of the desired length. This must be threaded at each end for nearly the length of the bell.

First, screw on a locknut to the end of the thread. Next comes a pipe-cap of large size. Into this fit a piece of large pipe about a foot long. A second locknut holds that in fixed position. Slip a loose-fitting



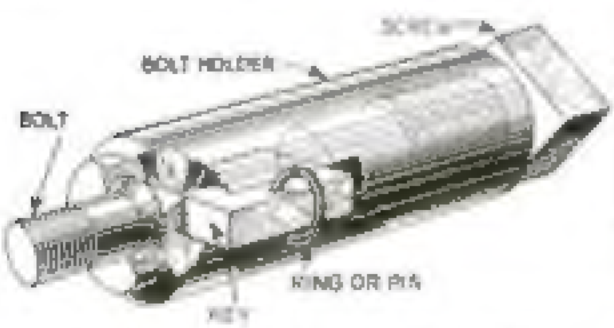
Athletes in training for a systematic development should try dumb-bells like these

disk over the threaded end of the handle pipe and thread on a third locknut back of that. The barrel is then completed by fitting on a second cap. This construction is shown in detail. There are, of course, two such bells, one at each end of the bar.

When the dumb-bell is fully assembled, drill a ¼-in. hole in the barrel of each, and close it with a wooden plug. As the athlete increases in strength he may increase the weight of the dumb-bell by taking out the plugs and inserting BB shot. When enough have been inserted, screw down the disks upon the shot.

Holding Round-Headed Bolts while Cutting Threads

SHOWN in the accompanying illustration is a device that is used for holding ¾ by 2¼ in. countersunk head-bolts while the thread is being cut in the bolt-cutter. The holder is made of machine steel, case-



This jig is valuable in shops where round-headed bolts are threaded

hardened, and is securely clamped in the jaws of the bolt-cutter with the slot in a vertical position, and extending ahead of the jaws. A bolt is then inserted into the slot, either from top or the bottom, and pushed forward into the countersink.

The hardened key is then placed into the slot until its ring or pin rests on the holder. This brings the knife edge of the key into line with the bolthead.

The screw at the rear is then tightened, causing the knife edge of the key to sink into the head of the bolt and preventing it from turning.

To remove the bolt, the screw is loosened and the key lifted out; when the bolt is pushed back, it will drop out.

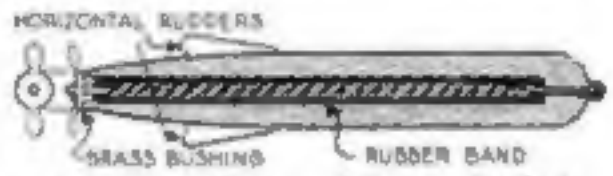
This Toy Torpedo Was Once an Old Curtain-Rod

THE solid end of an old curtain-pole can be made into a toy torpedo with little trouble. The center is bored out and a hook is placed in the forward end as shown. To this hook are fastened several strands of

Driven by a propeller actuated by the uncoiling of rubber bands, this toy torpedo will travel with surprising speed

rubber bands similar to those used on model airplanes.

A little brass bushing is placed in the opposite end of the torpedo. This also carries a hook, to the free end of which is



It is a good test of the mechanical ability of a boy to make this toy torpedo, simple as it is

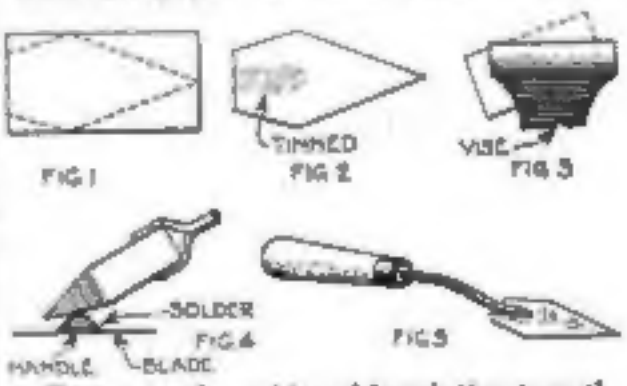
soldered a simple little propeller cut from a piece of thin brass. The center of the propeller is made flat, as shown, so that it will revolve freely against the surface of the brass bushing.

Two stationary horizontal rudders are put on to prevent the torpedo from obeying the torque of the propeller when it is in motion.—W. C. ROYER.

A Pointing Trowel Made from an Old Saw-Blade

BY soldering a thin piece of an old saw-blade to a discarded iron trowel handle, a good pointing trowel may be made as illustrated in the picture.

The saw-blade is cut in the desired form with a chisel, and the part to which the handle is to be soldered is first cleaned with sandpaper and then tinned. If you



Every step in making this pointing trowel from an old saw-blade is here illustrated

have no old handle, you can make one from a piece of wood and a piece of heavy wire or iron bent as shown.

Place the handle on the tinned portion of the blade and rest the hot soldering-iron on it until blade and handle are soldered together.—JAMES M. KANE.

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